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INDEX

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SUBJECT

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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

The Raft Lake canals are part of the extensive Seine River diversion scheme carried out by Steep Rock Iron Mines Limited to enable them to pump Steep Rock lake dry and mine the otherwise inaccessible high grade iron ore bodies in the lake bottom.

The cut for the west canal, shown in the cover picture, was carried out by a method employing diamond drills and a pilot tunnel.

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STEEP ROCK IRON MINES

Discovery and Development

W. SAMUEL

Chief Engineer, Steep Rock Iron Mines Limited, Toronto, Ont.

Paper to be delivered at the Fifty-Ninth Annual Meeting of The Engineering Institute of Canada, in Winnipeg, Man., on February 7th, 1945.

The iron bearing ranges of the Lake Superior district lie to the south and to the west of Lake Superior (Fig. 1). First iron ore was discovered in 1845 on what is now the Marquette range, Michigan. Shortly afterwards, ore was found on the Menominee and Gogebic ranges of Michigan and the Vermillion range of Minnesota. The Mesabi and the Cuyuna ranges of Minnesota were discovered in 1893 and 1912 respectively. From these discoveries developed the huge ore mining and transportation system of today, whereby an annual average of about 50,000,000 tons of ore increasing to 90,000,000 tons during war years has been mined and shipped by rail to Lake Superior ports and from here by lake boats to ports on Lakes Michigan, Erie and Ontario for transfer to the blast furnaces of east-central United States and Canada.

To the west of Lake Superior, the boundary between Canada and the United States passes about 25 miles north of the Vermillion range and about 60 miles north of the Mesabi range. It is natural therefore, that for the past 60 to 80 years, much attention has been paid to the possible presence of comparable iron ranges in Ontario, north of the Minnesota boundary.

In 1882, an Indian found a deposit of magnetite east of Sapawe lake, about 10 miles east of Steep Rock lake and locations were taken up by the McKellar brothers of Fort William. In 1905, the property was taken over by the Atikokan Iron Company Limited who erected a roaster and small blast furnace at Port Arthur. This plant operated from 1909 to 1911, but the pig iron produced was too high in sulphur and the operation was abandoned.

In the 1800's the main travel route from Lake Superior to western Canada passed close to, if not through Steep Rock lake, and one often wonders if some of the voyageurs did not take east with them occasional specimens of float iron ore picked up from the shores of the lake. However, the earliest record of the iron ore possibilities of Steep Rock lake is a note in the margin of a Geological Survey of Canada map of the Rainy River area by Messrs. Smith and McInnes, published in 1897 and which reads as follows:

> "An iron bearing horizon with hematite of good quality appears to be generally covered by the waters of the lake."

Numerous pieces of high grade iron ore float or boulders from the size of gravel to over five tons in weight are distributed along the south shore of Steep Rock lake and in the country for about four miles to the south of the lake. While no float has been found along the north shore and to the north of the lake, this

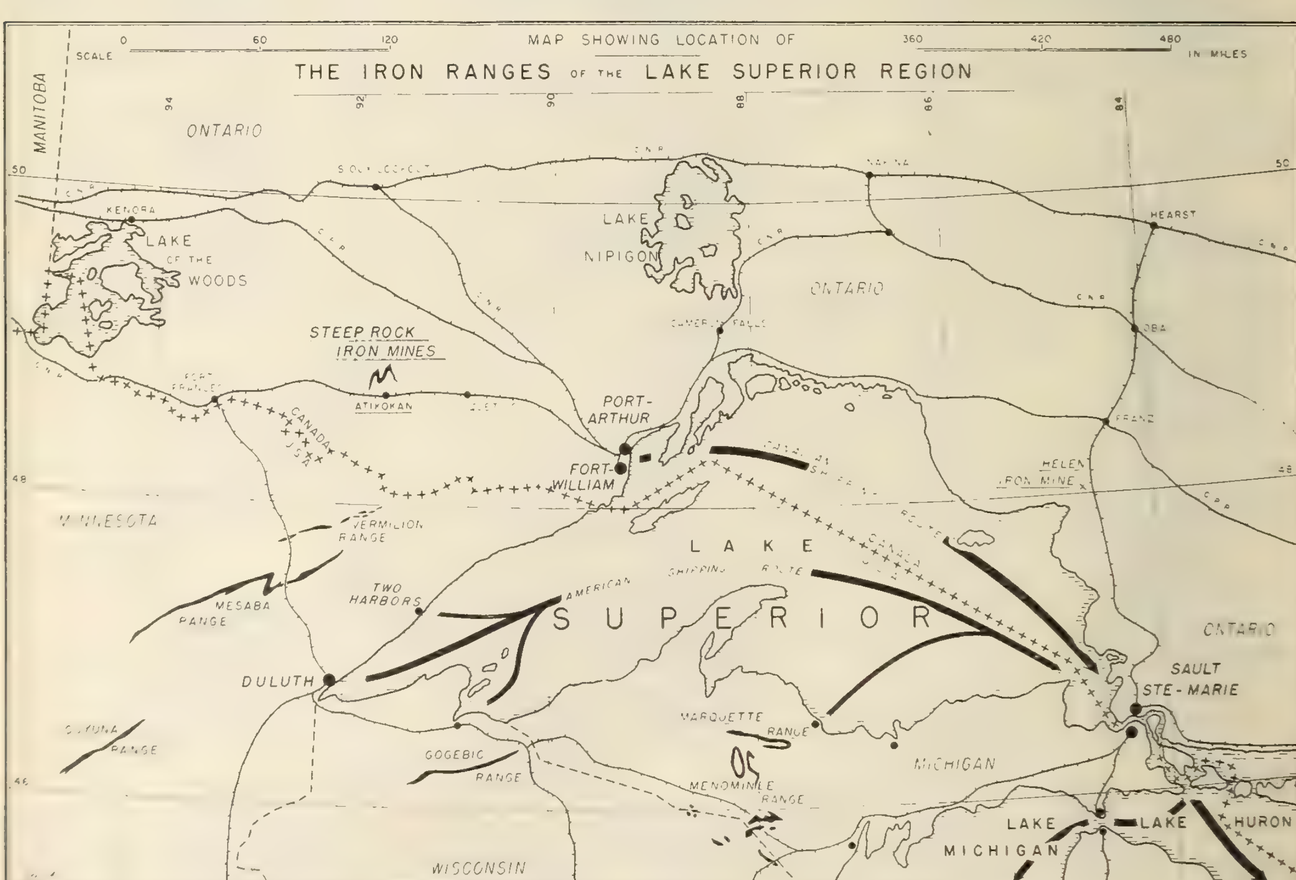


Fig. 1.

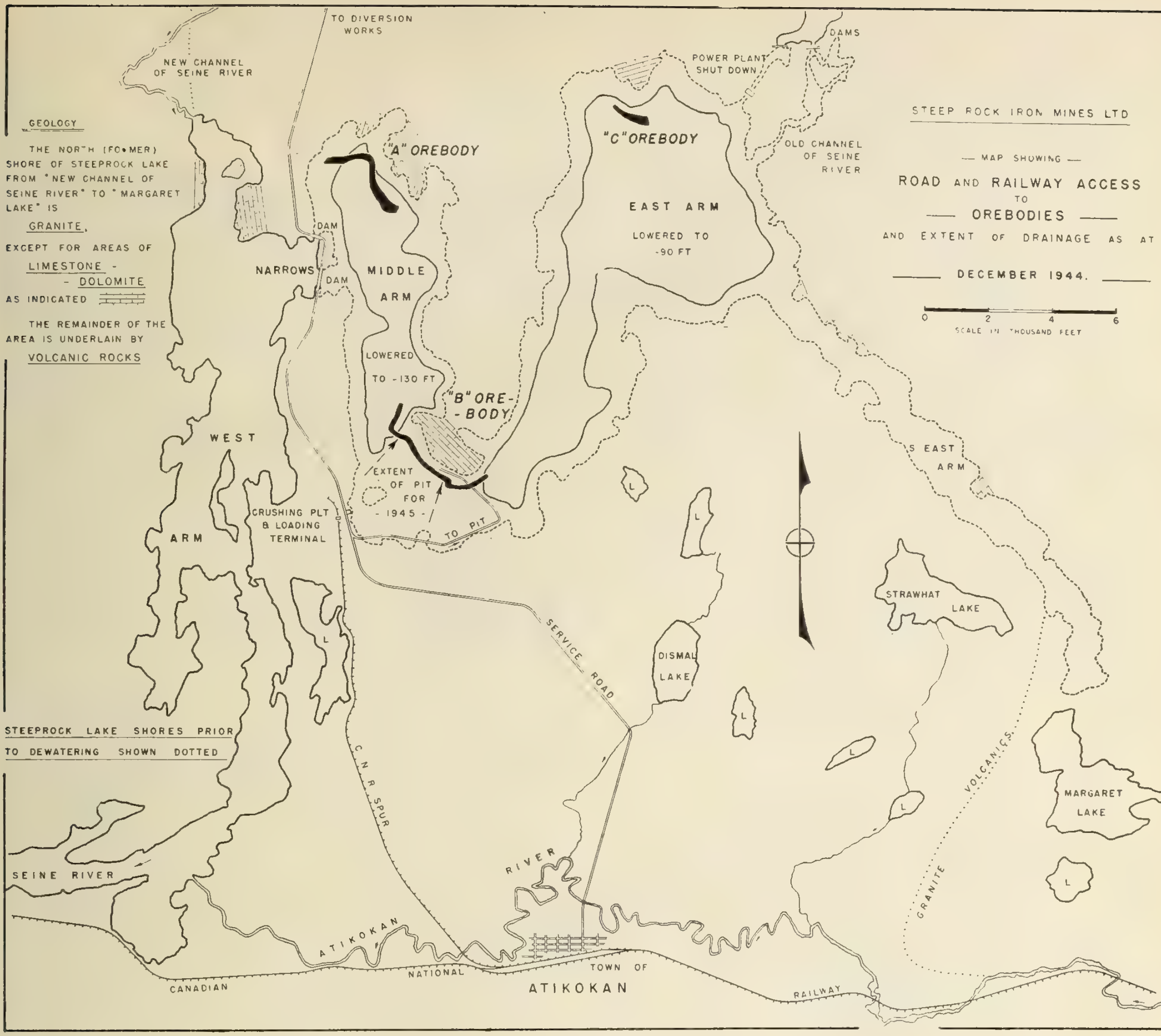


Fig. 2.

indicated that the iron orebody, or orebodies, occupied part of the bed of the lake itself.

Since 1900, considerable sums have been spent without success in the search for the source of the float to the south of Steep Rock lake. In the winter of 1926, Jules Cross of Port Arthur became interested and made a magnetic survey with a dip needle of the middle arm of Steep Rock lake which showed two areas of low magnetic attraction, somewhat similar to the attraction caused by some deposits of hematite ore with a small magnetite content on the Lake Superior ranges. Cross tried to interest various people and in the fall of 1937 brought the proposition to Joseph Errington. They agreed to join as equal partners in the search for the source of the float ore.

Exploration

In January of 1938, a diamond drill was set up on the ice of the middle bay of Steep Rock lake (Fig. 2.) at the centre of the northern zone of magnetic attraction but failed to reach bedrock after passing through 160 ft. of water and 160 ft. of clay-silt. The drill was then moved to the centre of magnetic attraction of the southern zone and two holes were put down into bedrock after passing through 90 ft. of water and 50 ft. of clay-silt and gravel. These holes showed that bedrock consisted of a greenstone which carried numerous grains of magnetite but in no sense an iron ore, eliminating the magnetic location theory.

The geologist who was in charge of the diamond drilling at that time noted that the two drill holes exploring the south magnetic zone passed through a thick layer of sand and gravel before entering bedrock and that this sand and gravel contained numerous grains and fragments of hematite. As a result of this observation, it was decided to drill a series of holes up the middle arm of the lake noting the amount of hematite in the gravel immediately above bedrock, until a point was reached where no hematite was found in the gravel. From here it was deducted that the orebody lay to the south, since glacial ice movement in this country is from north to south.

The drill was moved northward to the centre of the north magnetic attraction zone and hole No. 5 showed bedrock to be magnetite in greenstone, thus confirming the results of exploration of the south magnetic zone. The gravel, however, carried very numerous pieces of hematite, suggesting that an orebody lay a short distance to the north. The drill was moved northward 500 ft. and hole No. 6 showed bedrock at this point to be high grade hematite. Seven more holes at 100-ft. intervals on a north and south line were put down before it was necessary to move the drill from the ice. Of these seven holes, six showed clean hematite ore and one limestone.

Several angle diamond drill holes were put down from the shores of the lake to cut the "A" and "B" orebodies. Of these, one showed ore toward the west end of the "A" orebody at a depth of 1100 ft. below bedrock and three on the "B" orebody between 300 and 600 ft. below the bedrock, but owing to the position of the orebodies in the lake and the steepness of the shores, long, costly holes were required so the method was abandoned in favour of drilling vertical holes from the lake ice.

Two methods of drilling from the lake ice were used in the exploration of the ore deposits at Steep Rock, namely, "scout drilling" and "churn drilling" (Fig. 3.). In scout drilling as the name suggests, a light casing was washed to bedrock as quickly as possible and just sufficient diamond drilling done to obtain a sample of bedrock material. In churn drilling, larger casings were washed to bedrock, and the hole continued by chopping for 300 to 400 ft. into bedrock when in ore. The action of the chopping bit was such that in most of the work the steel casing slipped down the hole within six inches of the bottom as the hole advanced. On occasions when the casing would not sink of its own accord, it was raised a short distance and a five-foot length of 50 per cent Polar dynamite cased and sealed in a rubber tube was lowered to the bottom of the hole and fired electrically. This chambered the hole sufficiently to allow the casing to be lowered to the bottom of the hole. Diamond drill equipment was used in this churn drilling and on the rare occasions when the ore was too hard to chop, diamond drilling was resorted to.

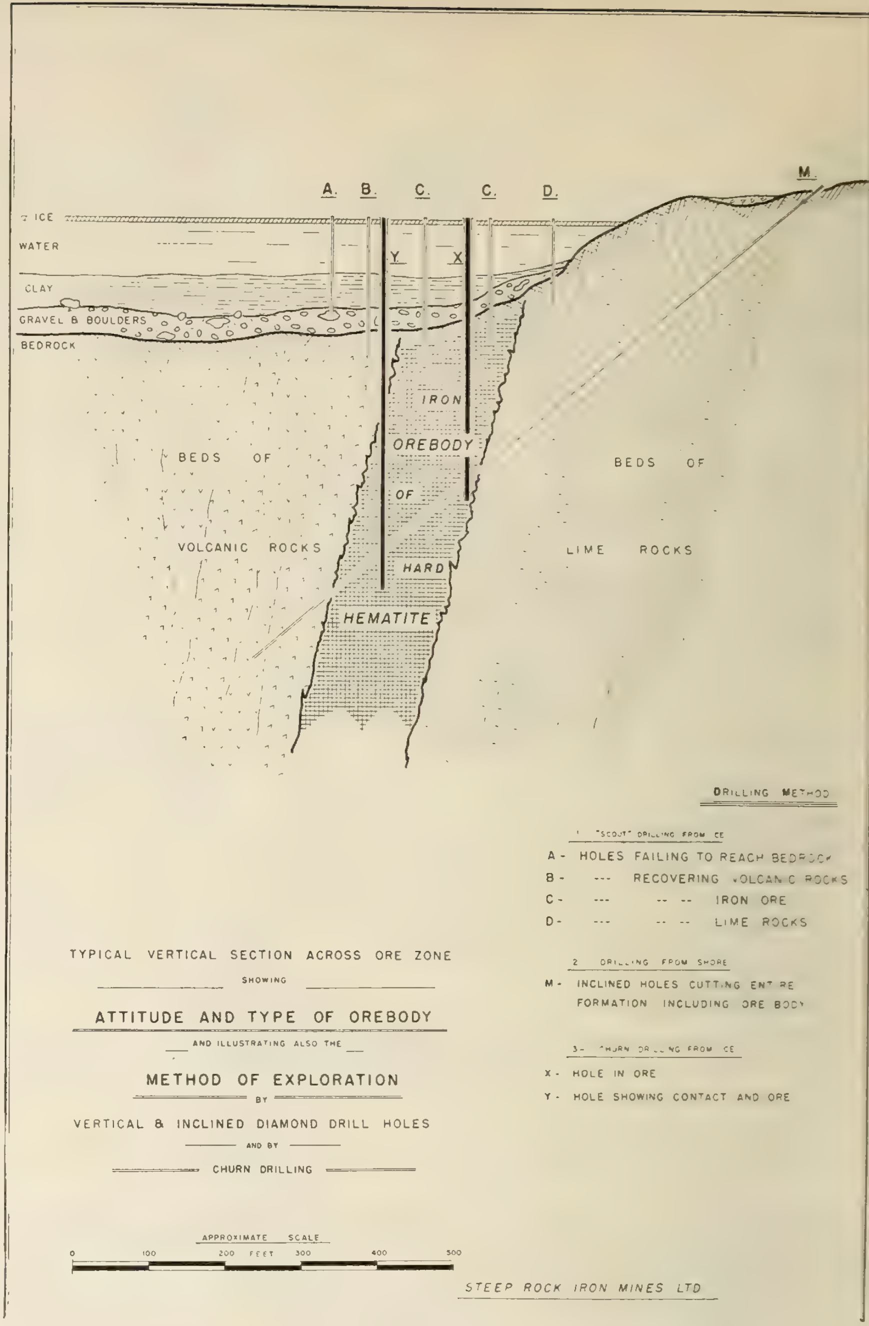


Fig. 3.

Core recovery was poor in the scout drilling but it quickly indicated the extent of the orebodies. In churn drilling, the choppings were collected in large sludge boxes and were sampled and analysed at five-foot intervals. Since the steel casing was brought to within six inches of the bottom of the hole at the end of each five-foot run and the hole washed out, sampling results were very reliable and satisfactory. Including water and clay in both cases, a total of 110,900 ft. of diamond drilling and 27,800 ft. of churn drilling were completed in the exploration of the orebodies.

During the winters of 1938-1939 and 1939-1940, the "A," "B" and "C" orebodies were explored by scout drilling. The geophysical studies carried out by Dr. Brant of the University of Toronto* were of great assistance in the layout of this work. Churn drilling mainly on the "B" orebody was carried out in the winters of 1940-1941 and 1941-1942. A shaft was sunk in 1939 and a cross-cut driven about 400 ft. below the lake bed toward the "A" orebody. On nearing the orebody, several diamond drill holes were put out which showed the orebody to extend to more than 1,000 ft. below bedrock at the deepest point explored; these holes cut water bearing seams in and near the orebody which indicated that it would probably be troublesome to attempt to mine ore from underground workings at shallow depths without removing the lake water above; at the same time, exploration showed that by removing the lake water, ore would be available for cheaper open pit mining.

Geological mapping of the country around the lake and the exploration described above showed the rocks of the country to the north and east of Steep Rock lake to be granites with small outcrops of limestone along parts of the lake shore (see Fig. 2), while to the south and west they were volcanic greenstones. The lake bed itself in the parts explored is underlain by limestones, in places altered to dolomite and the first members of the volcanic rocks.

* See *Engineering Journal*, Nov. 1940, p. 464.

The "A," "B" and "C" orebodies lie in the brecciated contact zone between the limestone and the volcanic rocks. The hematite has completely replaced the original rocks forming massive high grade orebodies, dipping about 80 deg. to the west. In composition the ore lies about midway between a hematite and a limonite or $Fe_2O_3 \cdot \frac{3}{4} H_2O$ and all impurities are not over five per cent.

The "A" orebody has an indicated length of 3,200 ft., with possible extension at the south end and width from 175 to 300 ft.; it has been closely explored at shallow depths and partially explored to depths of over 1,000 ft. below bedrock.

The "B" orebody has an indicated length of 4,500 ft. with possible extensions at both ends and width from 125 to 250 ft.; for half of its length it has been closely explored to 400 ft. below bedrock.

The "C" orebody has had very little exploration as yet and neither the length nor the width are known, but an orebody with a length of over 1,100 ft. and width of over 200 ft. is indicated.

The company's consulting engineers estimate that there are some 31,000,000 tons of proven and probable ore in the "A" and "B" orebodies. This quantity of ore is limited only by the amount of exploration work done to the present, and the author's personal opinion is that the mine will ultimately produce many times the 31,000,000 tons of ore estimated above, since the estimates take into account ore for only a comparatively short distance into bedrock, whereas the orebodies have an almost vertical dip and there is no reason why they should not persist to depths now attained in mining iron ore on the Vermillion range and in mining gold and nickel-copper ores in the Canadian shield. The "C" orebody is not included in the ore estimate because of the small amount of work done on it as yet. Geological conditions and the presence of float suggest that other orebodies as yet undiscovered lie beneath the bed of Steep Rock lake.

Exploration by churn drilling has been almost completely confined to the "B" orebody as this orebody is most easily opened up, and the analysis given below is the average for the estimated 14,000,000 tons of standard ore of the "B" orebody. Work to the present suggests that the "A" orebody is slightly higher in grade.

Average Value of "B" Orebody
(Dried Ore)

Iron	60.48%	
Phosphorus	0.023	
Silica	3.40	
Sulphur	0.043	
*Loss by ignition	8.61	
Manganese	0.15	Analysis of composite sample
Alumina	0.66	
Lime	0.11	
Magnesia	0.38	
Titanium oxide	0.03	
Lead	0.001	
Copper	0.012	
Zinc	0.012	
Arsenic	0.026	
Chromium	0.023	
Vanadium	0.007	
Nickel	0.015	
Cobalt	0.022	

*Water of crystallization.

Iron ores as shipped contain varying amounts of moisture and payment is made on the "natural iron" content of the ore, that is including this moisture. Steep Rock expects to ship four grades of ore of the following approximate compositions.

Lump Ore		Size 4″ to 10″.
Iron	61% (Dried Analysis)	
Phosphorus	.025	
Silica	3.5	
Moisture under 4%		Natural Iron 58.5%
Intermediate Ore		Size 1″ to 4″
Iron	61% (Dried Analysis)	
Phosphorus	.025	
Silica	3.5	
Moisture under 4%		Iron Natural 58.5%
No. 1—Fine Ore		Size Minus 1″
Iron	60% (Dried Analysis)	
Phosphorus	.025	
Silica	4.0	
Moisture 8%		Iron Natural 55.2%
No. 2—Fine Ore		Size Minus 1″
Iron	57.5% (Dried Analysis)	
Phosphorus	.03	
Silica	8.0%	
Moisture 10%		Iron Natural 51.8%

It is difficult to estimate closely into what proportions the ore will be divided in mining, but it is expected that the quantities of the four grades will be as follows:

Lump Ore	20%
Intermediate Ore	30%
No. 1 Fine Ore	30%
No. 2 Fine Ore	20%

Value of Steep Rock Ore in the Steel Industry

The iron ranges producing more than 90 per cent of the ores from the Lake Superior district have been in operation for between fifty and one hundred years. It is understandable therefore, that as the direct shipping ores of the ranges approach exhaustion, lower grade ores are being and will be mined. These lower grade ores have as their main feature a lowering of the iron content and an increase in the silica content to such an extent that concentration of various sorts is becoming increasingly prevalent. Best blast furnace practice calls for an ore charge with a silica content of 7 per cent in order that there will be sufficient slag to clean the metal of impurities. Steep Rock's No. 1 Fine Ore with its very low silica content will therefore be in demand to mix with cheap high silica ores to make a desirable blast furnace feed. The texture of the ore is also desirable, and its phosphorus content is also much below the maximum allowed for the classification of Old Range Bessemer Ore (the highest classification and most valuable standard ore in the iron ore business).

Open hearth furnaces, in which pig iron is converted into steel, use considerable amounts of lump and intermediate ore. In this operation the low silica and phosphorus content and the lumpy nature of these sizes of Steep Rock ore make it very desirable, as tests have shown that the time required to complete a charge in the open hearth furnace when Steep Rock Intermediate ore is charged, is considerably less than when other charge ores are used, thus increasing the capacity of the furnace. Also, it is likely that when Steep Rock Intermediate ore is used in a charge, the amount of ore can be increased and the amount of scrap iron reduced, thus decreasing the cost of steel production. For many years there has been a considerable shortage of good charge and feed ore in the American and Canadian steel industry.

Pumping installation, showing connection to shore and flexible couplings. Lake down 15 ft. when picture taken; now down 135 ft.

Raft Lake cuts about 10 mi. north of Steep Rock lake connecting Marmion to Raft lake and Raft lake to Finlayson lake, the construction of a spillway and control gates in the bed of Raft lake, the lowering of Finlayson lake which was done by breaking a rock tunnel through into the lake bottom, the excavation of an earth and rock cut through a terminal moraine at the south end of Finlayson lake called the Esker cut, and the clearing of a channel from the Esker cut to the west arm of Steep Rock lake.

The diversion work described above was done in 1943 and two coffer-dams were built at the narrows between the west arm and middle arm of Steep Rock lake which were later strengthened into permanent dams. In December, 1943, the power plant was shut down and all flow between Marmion lake and the eastern portion of Steep Rock lake was sealed off. The coffer-dams were completed and the Seine river passed through its new diversion route. This isolated the eastern portion of Steep Rock lake and pumping was commenced.

The Canadian steel industry is small in comparison to the size of the country and its population, probably because it has been dependent on foreign sources for almost all of its ore, but with the opening up of large potential reserves at Steep Rock lake it is likely that the next generation will see a considerable expansion in the Canadian steel industry and its associated heavy industries, particularly in centres where ore and coal can be cheaply brought together at points where low cost hydro-electric power is available.

The Diversion of the Seine River

The company decided that it was necessary at first to lower and finally remove the water from the eastern portion of Steep Rock lake, in order to make large quantities of ore available for cheap open pit mining, and later to make safe underground mining possible. Much study was given to the problems presented by this decision, as the Seine river which drains an area of over 1,800 sq. mi. passed through the lake. Marmion lake, immediately above Steep Rock lake had been dammed and raised as a storage lake with an area of about 32 sq. mi., and there was a fall of 100 ft. with a power plant between Marmion lake and Steep Rock lake, and other power plants on the Seine river between Steep Rock lake and Rainy lake.

It was found to be impossible economically to divert the Seine river from the eastern portion of Steep Rock lake and still leave the power plant intact, so arrangements were made with the owners of the plant and the government of the province of Ontario through the Hydro-Electric Power Commission for a power line to be built from Port Arthur to Steep Rock, a distance of about 130 mi., to supply power from the Lake Nipigon system of the Commission for pumping and mine operation and to replace power then generated at the plant at the head of Steep Rock lake.

A feasible route for the diversion of the Seine river away from the eastern portion of Steep Rock lake was found which required the raising of the spillways at the power plant, the excavation of two rock cuts called the

Pumping Lake Water

Detailed surveys and soundings were made of the eastern portion of Steep Rock lake and from these it was estimated that this portion of the lake held some 118,000,000,000 U.S. gallons of water, but that by pumping 70,000,000,000 U.S. gallons the lake water would be lowered sufficiently to permit commencement of overburden removal and mining of ore on the "B" orebody. To remove the lake water, it was necessary to start pumping against almost no head and end against a total head of about 200 ft.

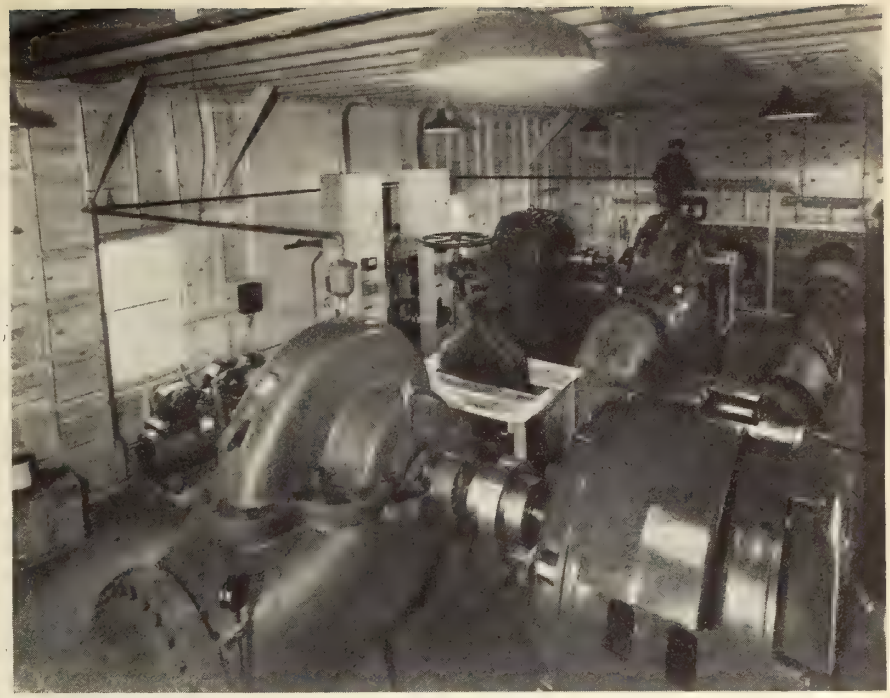
Pumping equipment consisted of fourteen 30-in. suction, 24-in. discharge, centrifugal pumps with specially designed impellers so that they were reasonably efficient at low heads as well as efficient at their designed head of 98 ft. Twelve pumps were driven by 500 hp. squirrel cage induction motors and two by wound rotor motors. Seven steel barges were constructed and two pumps were installed on each barge in such a way that the lake was lowered about 80 ft. by the pumps operating in parallel. At this depth, the two pumps on each barge were connected in series and so were capable of pumping against a total head of over 200 ft.

At depths up to 55 ft., each pump had a capacity of over 23,000 U.S. gallons per minute, or a total capacity of 322,000 gallons per minute (717 cu. ft. per sec.); at the designed head of 98 ft. each pump had a capacity of 18,000 U. S. gallons per minute or a total capacity of 252,000 gallons per minute (561 cu. ft. per sec.); at a total head of 200 ft. the pumps would have a total capacity of 126,000 gallons per minute (280 cu. ft. per sec.).

The eastern portion of Steep Rock lake had a length of about ten miles, a surface area of about four square miles and it was estimated that the surface should fall at an average rate of a little over six inches a day. Pump operation was very satisfactory in every way and the lake surface fell a little faster than the estimated rate. No inflow other than that from the residual drainage area around the lake was anticipated as the lake lay in a rock basin. This judgment has proved correct and an average inflow of under 10,000 U. S. gallons per minute only must be handled.

Overburden Removal and Preparation for Production

The "B" orebody lies around and close to the south end of the headland that divides the east arm from the middle arm of Steel Rock lake; its outcrop slopes with the bordering rocks downward into the lake bottom as shown in Fig. 3, and the depth of overburden in the part to be first mined, varies from a minimum of about 25 ft. to a maximum of about 100 ft. It was difficult to properly judge the composition of the overburden before the lake water was removed, but samples taken in drilling showed it to be a clay-silt, with sand and gravel on bedrock. It was appreciated that it might be difficult to place mechanical equipment on this water-logged ground so it was decided to break down the overburden with monitors or hydraulic jets and collect the resulting slurry in a sump or pond in which floated a barge with a dredge pump to pump the disintegrated overburden to disposal points in the lake bottom. Water for the monitors is supplied by one of our pump barges, which was moved into the east arm of the lake last spring for this purpose. The suction dredge is equipped with a 15-in. harbour type dredge pump capable of pumping to a total head of 180 ft. and of passing gravel and boulders up to ten inches in diameter. This pump is driven by a 750 h.p. wound rotor motor with special speed controls. A three-drum hoist is installed to raise and lower the suction head and to move the dredge in the pond or sump. The monitors and dredge began operation early in July and the dredge has been lowered 40 ft. into the overburden removing considerably more than 100,000 cu. yd. of clay silt monthly. When gravel and boulders show up monitor operation is stopped and clean-up of bedrock is done by dragline, shovels, trucks and bulldozers.



Two pumps set up on the centre line of a barge—picture shows pumping in parallel—when pumping in series, the suction of No. 2 pump was eliminated and No. 1 pump's discharge was connected through to the intake of No. 2.

Pit equipment consists of:—

3—2½ cu. yd. Diesel shovels.
1—1-cu. yd. Diesel shovel.
11—15-ton heavy duty ore trucks.
6—4-ton dump trucks.
4—tractors and bulldozers.
6—well (churn) drills 6-in. bit,

together with electric drive compressor and rock drills.

To properly prepare the ore for shipment, a crusher and screening plant was erected at the west side of the middle arm on the Canadian National Railway's spur. In this plant, ore is dumped from the trucks into a bin, and passed by a Ross feeder over a grizzly with bars set ten inches apart. The undersize passes to a 36-in. belt conveyor, oversize is crushed in a 48-in. by 60-in. jaw crusher, joins the grizzly undersize and is elevated by conveyor to the top of the railway loading bin, where the ore is passed over a heavy duty 6 by 12 ft. double deck shaking screen and divided into three sizes 4 to 10 in., 1 to 4 in. and minus 1 in., which fall into three loading pockets.

Empty, bottom dump ore cars are stored by the railway company to the north of the loading terminal; from here they are passed by gravity on a 1½ per cent compensated grade through the terminal where they are loaded and on the full storage yards.

An ore haul road was constructed in the early summer from the crusher plant and loading terminal a distance of 7,000 ft. to the pit which had been opened up on the highest point of the "B" orebody. By the middle of October, this pit was of sufficient size to show that the character of the orebody was in every way up to expectations and it was possible to send two boat loads of ore to eastern furnaces. At this time a slide of bank material came on the ore bench and held up operations for the few remaining weeks of the shipping season.

The company plans to move as much clay-silt hydraulically as possible this winter, assisted by dragline operation and to open up and place on a stockpile near the crusher plant a considerable tonnage of ore, so that there will be a good reserve of mined ore available at the start of the shipping season towards anticipated production for 1945 of over 1,000,000 tons of ore.

The Canadian National Railways built the spur line from the division yards at Atikokan to the loading terminal, a distance of about three miles. Ore trains will be made up and taken to Neebing, just outside of Fort William, where the cars will be sorted to grade the ore and taken to the ore dock at Port Arthur, through which the ore will pass to the holds of the ore boats of the Great Lakes and so into the normal stream of iron ore from the Lake Superior district to eastern Canadian and American furnaces.

DIVERSION OF SEINE RIVER AT STEEP ROCK

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Quite early in the engineering investigations at Steep Rock it became apparent that the rich iron ore deposits lying beneath the lake could not be reached by ordinary underground mining methods. The only practicable alternative was to divert the Seine river from its course through Steep Rock lake, pump the lake dry, and strip the overburden from its bed, so that the ore could be mined by open-pit methods. This scheme, therefore, was adopted. Its magnitude and the difficulties that might accompany such an operation can, perhaps, be realized by a study of the map of the region shown herein as Fig. 1.

From this map it will be seen that the main source of supply for Steep Rock lake is the Seine river, all other direct drainage being very small in amount by comparison. Prior to its diversion, the Seine river flowed through Marmion lake, dropped over Steep Rock falls into Steep Rock lake, thence through the three arms of the lake in succession to its outlet at the head of Tracy rapids. The feasibility of making the diversion and unwatering was based upon geological assurance that the bottom and sides of the basin of Steep Rock lake were entirely composed of tight, pre-cambrian rocks and that, such being the case, no material flow of water had access to the lake from underground sources. This meant that, after diversion, the water to be disposed of by pumping comprised only the residual water content of the lake itself, and the comparatively negligible surface run-off from the area immediately adjacent to its shores.

As mentioned above, Steep Rock lake consists of three main reaches or arms known respectively as the Eastern, Middle, and Western arms and, as an initial development, it was decided to unwater only the Eastern and Middle arms covering an area of about four square miles.

The problem of isolating the Middle and Eastern arms to allow unwatering was simplified by the existence of a narrow and comparatively shallow section between the Middle and Western arms known as the Narrows. This topographical feature allowed bulkhead dams of moderate dimensions to be designed, and constructed at this point. On the other hand, this problem was considerably complicated by the Moose Lake power development at Steep Rock falls between Marmion and Steep Rock lakes, since any scheme of diversion required the abandonment of this plant and the securing and delivering of a satisfactory supply of replacement power. The difficulties and expense attendant upon this phase of the scheme, and also upon retaining to the Power Company its use of Marmion lake as seasonal and yearly storage for power plants further downstream were, however, partly offset by the fact that the power dam, spillway, and headworks could be used, with but minor alterations, to close the inlet to Steep Rock lake.

After making extensive explorations and surveys, the most economical and practical route for the diversion of the Seine river was found to be from Marmion lake to the west by a heavy rock cut to Raft lake, through Raft lake and into Finlayson lake by another large rock cut; then, through the esker at the south end of Finlayson lake by means of another huge cut, from the outlet of which the diverted water would flow into the lowlying and swampy area to the south; and finally, into the west arm of Steep Rock lake at Wagita bay, through a low spot in the intervening rock ridge.

It was required that provision be made in the diversion scheme, if possible, to facilitate the unwatering of the Western arm of Steep Rock lake should the discovery of ore under it make such a step advisable at some time in the future. For this reason, the lower portion of a small bulkhead dam near Wagita bay was included in the programme. This will function for the time being as a free overflow spillway. Diversion of the Seine river away from the Western arm of Steep Rock lake could then be accomplished later by making two minor rock cuts to the south of the swamp area, completing the bulkhead at Wagita bay to its full height, and constructing a new bulkhead to close the present outlet of Steep Rock lake. If the Wagita Bay dam is completed, the water impounded behind it will flood the swamp area previously mentioned and the diverted Seine river will continue on its course through the two small rock cuts and then by an existing watercourse to rejoin its present channel at the foot of Tracy rapids.

Fig. 1—Map of Steep Rock Lake Area.

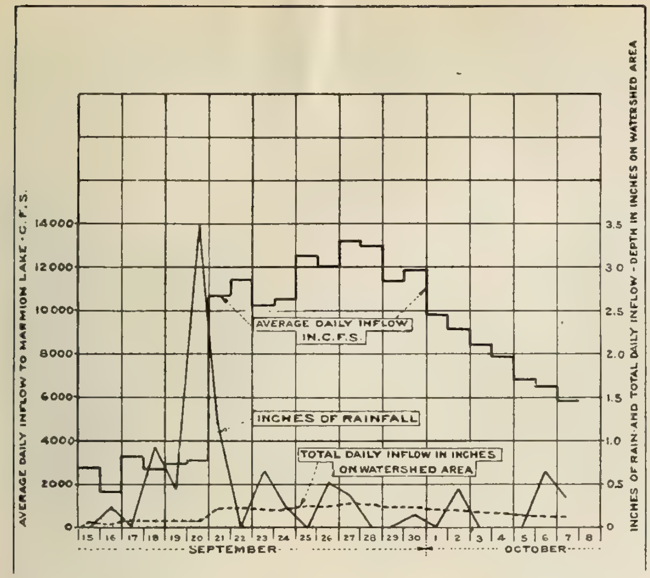

Fig. 2—Inflow and rainfall at Marmion lake during the storm of September 15th to October 8th, inclusive, 1941.

The basic hydraulic requirements for any diversion scheme at Steep Rock lake were two in number. It must, first of all, have sufficient capacity to pass all floods which otherwise might cause Marmion lake to overflow the existing power dam and inundate mining operations in Steep Rock lake. Secondly, it must allow the Ontario and Minnesota Power Company, owners of the Calm lake and the Sturgeon Falls hydro-electric plants further downstream, the same regulation of storage on Marmion lake as they had enjoyed prior to the construction of the diversion. Therefore, in addition to providing a new route of adequate capacity for the Seine river, a combined control dam and spillway located at or near the new outlet of Marmion lake was an essential and important element of the diversion waterway.

Flood Possibilities

The Seine river rises some fifty to sixty miles to the northwest of Port Arthur and Fort William, flows in a generally westerly direction through rough territory, and finally empties into Rainy lake, a cross-country distance of approximately 130 miles. At the inlet of Steep Rock lake its drainage area is about 1,810 sq. mi. The discharge of the river at this point has been measured in connection with the operation of the Moose Lake power plant, and according to these records, the average inflow to Marmion lake is about 1,040 cu. ft. per sec. with a maximum average daily inflow of 13,230 cu. ft. per sec. These figures represent an average run-off of 0.58 cu. ft. per sec. per sq. mi. and a maximum run-off of 7.3 cu. ft. per sec. per sq. mi. of drainage area.

The question of fixing an upper limit to the flow for which the diversion was to be designed, presented a problem of great difficulty and of more than usual importance. On the one hand, the size of the various cuts and, consequently, the cost of the diversion would be almost directly proportional to the magnitude of the adopted figure while, on the other hand, if the diversion were so limited in capacity that the run-off at any time overtopped the holding structures at the Moose Lake power plant and flooded the mine, Steep Rock Iron Mines Limited, the mining company, would suffer great loss both of material and of production.

The period of record referred to above, unfortunately, from the viewpoint of flood investigation, did not commence until 1927 so that figures for only 16 years were available at the time the engineering studies for the diversion were made. Their use as an aid in estimating the magnitude of possible large floods is accordingly definitely limited. This feature of the record, however, is partly discounted by the following circumstance. The maximum measured run-off at Marmion lake of 13,230 cu. ft. per sec. occurred on September 27th, 1941, following unusually heavy, prolonged, and widespread rainfall. The rainfall as measured at the Moose Lake plant is given in Table I and from this it will be seen that from the commencement of the storm on September 16th to its end on September 27th, a total of 8.03 inches was recorded for this 12-day period, while up to September 24th, three days before the maximum run-off occurred, a total of 7.13 inches was recorded. The really phenomenal fall, however, was the 4.62 inches of September 20th and 21st. Despite this extraordinary precipitation, the run-off was not excessive. For the ten-day period of heaviest flow into Marmion lake, the run-off represented, on the average, only 0.24 inches of precipitation daily on the entire drainage area or only 31 per cent of the precipitation as recorded at the Moose Lake power plant. The highest average daily run-off of 13,230 cu. ft. per sec. similarly represents only 0.27 inches of precipitation on the drainage area. These data illustrate the remarkable retarding effect on run-off caused by the numerous lakes, muskegs, and river courses of the drainage area, for even such an abnormal rainfall as that described. The graphical representation of rainfall and run-off given by Fig. 2 depicts this point in an even more striking manner than the figures given above.

As a further aid to judgment in arriving at a design figure for the maximum flow in the diversion, flood flow data for other watersheds in the district were examined. These data are illustrated graphically on Fig. 3. They include all measuring stations from Mine Centre on the west to Kaministiquia on the east. The maximum recorded flow at four of these ten stations occurred following the storm of late September 1941. These are shown by a special symbol on the figure, and it will be noted that the envelope curve for all points is defined by the points for three of these four stations.

TABLE I

Inflow and Rainfall Measured at Moose Lake Plant for Period September 15 to October 7, 1941, Inclusive

Date	Marmion Lake Inflow, c.f.s.	Inches of Rainfall Measured at Moose Lake Plant
Sept. 15	2,795	0
16	1,666	0.24
17	3,386	0
18	2,718	0.94
19	2,913	0.42
20	3,110	3.50
21	10,689	1.12
22	11,430	0
23	10,267	0.66
24	10,565	0.25
25	12,578	0
26	11,958	0.52
27	13,230	0.38
28	12,990	0
29	11,332	0
30	11,858	0.14
Oct. 1	9,843	0
2	9,185	0.45
3	8,513	0
4	7,903	0
5	6,896	0
6	6,545	0.65
7	5,907	0.34

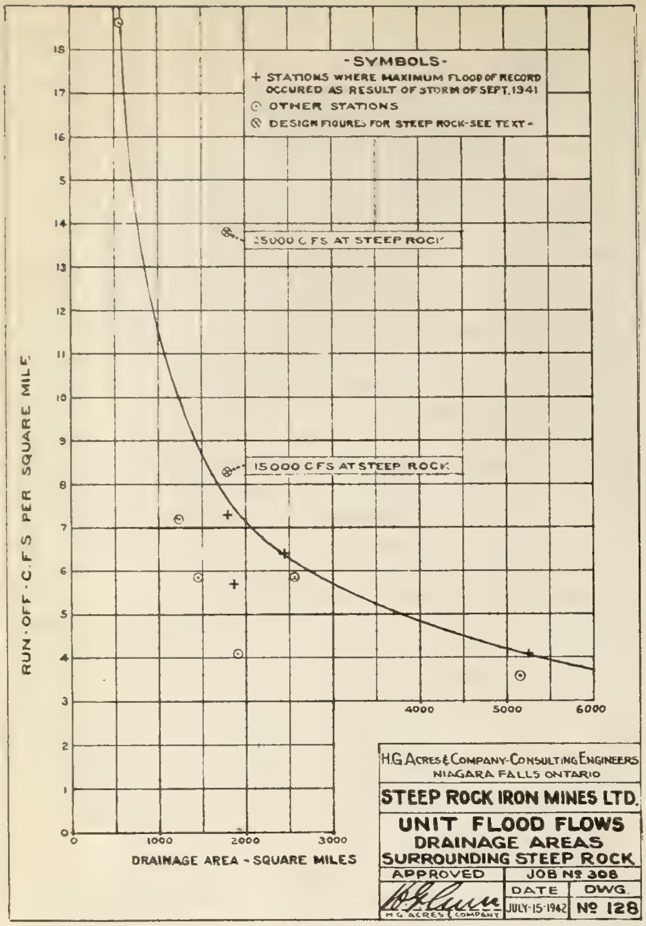

Fig. 3—Unit flood flows for drainage areas surrounding Steep Rock lake.

Following a study of the various points outlined above, it seemed reasonable to design the diversion so that it could pass 15,000 cu. ft. per sec. without overtopping the flashboards and bulkheads at Moose lake. As an additional protection to mining operations, an earth safety dam is planned for construction in the intake channel of the Moose Lake plant. This dam will have a crest at elevation 1,375 which will allow the diversion to carry 25,000 cu. ft. per sec. (13.9 cu. ft. per sec. run-off per sq. mi. of drainage area) with Marmion lake at a maximum elevation of 1,370.0.

General Hydraulics of the Scheme

The crest of the bulkhead portions of the dam at the Moose Lake plant, namely, elevation 1,367, fixed the maximum flood stage of Marmion lake, since it was undesirable to add to the height of these structures. The crest of the spillway is four feet lower, i.e.—elevation 1,363. Therefore, the scheme required that this be raised to elevation 1,367 by means of flashboards so designed that they could be readily removed, should mining operations be abandoned and the Moose Lake plant put into operation again.

The layout of the Moose Lake plant is such that the minimum practical operating level for Marmion lake is elevation 1,345. This low level had been reached during the lifetime of the plant and it therefore established the volume of storage for which the diversion scheme must provide. The retention of the Moose Lake power dam, without increase in height, meant that the normal maximum operating level of Marmion lake would remain unchanged. These two facts therefore fixed one important element of the diversion, namely, that it must carry the minimum regulated flow required by the power plants on the lower reaches of the river, with Marmion lake at elevation 1,345.

The maximum regulated level of Marmion lake is elevation 1,363, while the normal level of Steep Rock lake is elevation 1,263. There is thus available a fall of 100 ft. for the 10.4 miles of diversion. This total length of 10.4 mi. is comprised of one mile of earth and rock cuts, 5.8 mi. of lake, and 3.6 mi. of new river channel.

Of the total 100 ft. of fall between the two lakes, only 34 ft. is actually available for producing flow in the various channels. This is due to the fact that the minimum practical elevation for the crest of the initial portion of the Wagita Bay dam is 1,325 and to pass flood flows over this crest required yet another eight feet (See Fig. 4).

Preliminary studies and calculations indicated that both the flood flows and the low-water flows could be carried through the diversion route without the necessity for excavation in either Raft or Finlayson lake. Moreover, since the general elevation of the swampy area to the south of the esker ridge is well below the initial crest of the Wagita Bay dam, it was possible to produce the necessary waterway through this area simply by clearing a strip through the undergrowth and timber. It was clear, also, that while the quantities of rock to be taken out from the two Raft lake cuts and of earth and rock from the esker cut were large, they

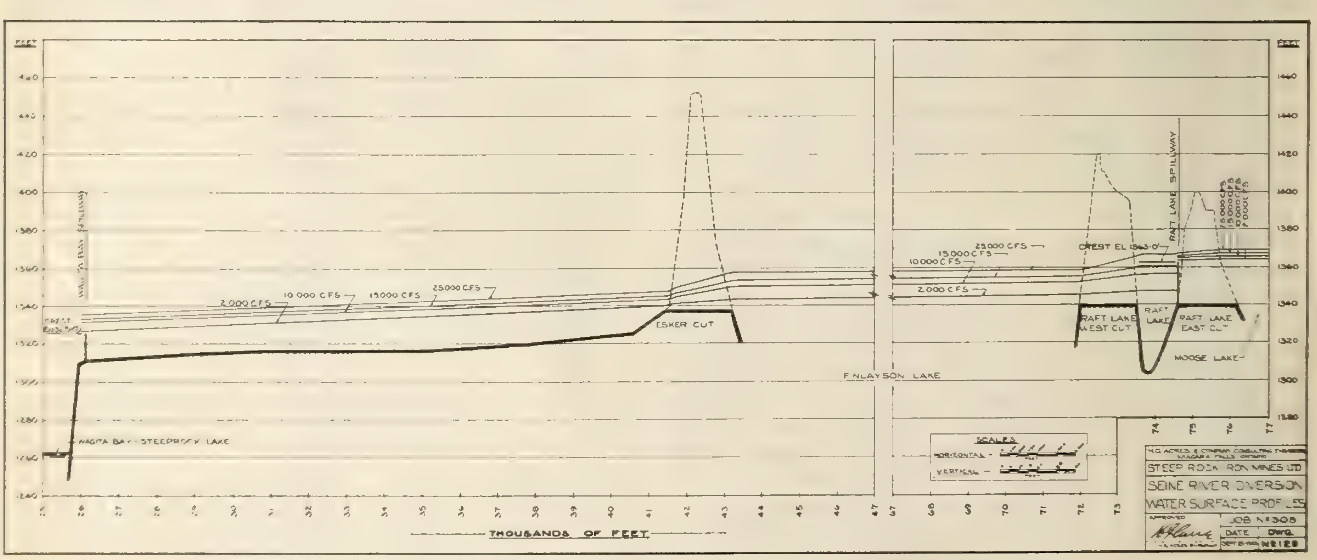

Fig. 4—Water surface profiles along the diversion.

Fig. 5—Raft lake east cut looking east from the control works.

within close limits, by the general slope of the diversion profile and that it was important to keep this elevation as high as possible in order to avoid excessive excavation. The effect of this was to produce a channel relatively shallow in proportion to its width and therefore hydraulically inefficient. This feature, combined with the high friction of the bottom and sides, produced a water surface profile having marked "drop-down" characteristics unusual in artificial channels.

This was a fortunate circumstance, as related to the general hydraulic problem of head loss determination. As mentioned above, the waterway from the outlet of the esker cut to the Wagita Bay spillway was nothing more than a right-of-way cleared through timber and underbrush. The friction co-efficients for such an unusual channel are not known with any degree of accuracy and hence it was impossible to calculate the losses in this stretch with any great precision. However, due to the shape of the profile through the esker cut, this was a matter of no importance because this lack of precision would have but very little effect on the level of the water surface at the entrance to the cut. If the losses in the stretch in question were sufficiently low, the esker cut would form a hydraulic control and the water level in it and at all points upstream would be unaffected by the flow downstream. With increasing losses, the control disappears and it is evident that the water surface profile in the cut moves downstream. Because of the sharp curvature of the profile at the downstream end, this lateral shift is comparatively small for quite wide variations in the losses in the cleared channel. On the other hand, the small lateral shift produces but very little change in the water surface elevation at the upstream end of the cut since the profile

were by no means excessive. These circumstances, therefore, not only eliminated any difficult and expensive swamp work but concentrated all excavation at three large cuts, where the material was relatively easy to take out and where disposal areas were close at hand and readily accessible. These features were a very attractive part of the adopted scheme since they contributed directly to shortening the construction period as well as to lowering the actual excavation costs.

Before making the detail hydraulic computations for the diversion, it was necessary to assign values for the friction coefficients to be used and also to determine, if possible, the location of the hydraulic controls. For a project being constructed on a rush schedule under wartime conditions, it is evident that the supervising engineer cannot maintain the same close control over construction methods and equipment as is possible on a normal peacetime job. Anticipating, therefore, that the sides and bottom of the rock cuts might be quite rough and indented, a friction coefficient of $n = .045$ was selected for all surfaces excavated in solid rock. It was felt that this figure would provide a fair margin of safety and yet not be unduly pessimistic. For the heavy rip-rap lining on the wetted perimeter of the earth portions of the esker cut, a friction coefficient of $n = .045$ was also adopted.

At the outset, it was obvious that the spillway and sluices at the outlet of Marmion lake would form a hydraulic control, as also would the Wagita Bay spillway. On the other hand, superficial examination and preliminary figures did not disclose whether or not the esker cut would form an intermediate control, and it was not until some considerable study had been given to this problem that the matter was finally determined.

As will be seen from Fig. 4, the profile of the water surface at the lower end of the esker cut is very sharply curved while at the upper end it is quite flat. This results from the fact that the elevation of the invert of the cut was determined,

Fig. 6—Raft lake west cut looking east; the control works can be seen in the background.

Fig. 7—The Marmion lake "plug" just before blasting.

here is quite flat. In other words, it was possible to determine the overall hydraulic losses from the upstream end of the esker cut to the Wagita Bay spillway with reasonable accuracy, even though the water level at intermediate points, as calculated, might be only quite approximate.

According to these studies, backwater from the Wagita Bay dam extends up to the downstream side of the spillway at Raft lake for all flows below about 22,000 cu. ft. per sec. For flows larger than this amount, this spillway becomes submerged and the level of Marmion lake is then influenced by the hydraulic characteristics of the entire diversion route.

It was originally planned to construct the spillway and control dam at the Marmion end of the Marmion-Raft cut. While this was the logical place for such a structure, this location involved either extensive cofferdamming or the drawing-down of Marmion lake to levels which would allow construction in the dry. Neither of these alternatives was very attractive; the former required considerable expenditure of materials and labour, while the latter entailed loss of storage and power. Consequently, the mining company would be under the necessity of supplying replacement power at an early date in the construction schedule. Accordingly, various other possible sites for the combined spillway and control dam were studied, but it was not until mid-summer of 1943 that a final decision was made. By that time, the pumping out of Raft lake had disclosed the existence of a reef of ledge rock near the end of the Marmion-Raft cut, so located that the required structures could be easily constructed on it with a minimum amount of materials and labour. Owing to the necessity of maintaining the elevation of Marmion lake within the range of levels previously described, the adoption of this site as against one at the outlet of Marmion lake, carried with it the necessity for accepting a very small, but nevertheless permanent, loss in diversion capacity. It was considered, however, that the advantages of the new site, from the viewpoint of constructional facility, far outweighed this factor and, accordingly, it was adopted.

Main Diversion Works

RAFT LAKE CONTROL DAM

The Raft Lake control works consist of a concrete gravity spillway section 820 ft. long, with crest at elevation 1,363 to conform with the existing structure at Steep Rock falls, three regulating sluiceways each 10 ft. wide with sills at elevation 1,340, and one log sluice 10 ft. wide with sill at elevation 1,352. The three regulating sluiceways and the log sluice are closed with timber stop-logs, handled by a spud-type, gasoline engine powered hoist operated from a reinforced concrete deck which spans the sluiceway openings. This deck is set at elevation 1,372, well above high flood levels, and allows access to the hoist at all times. While the location of the spillway provided a minimum of construction difficulties, it did introduce one design complication. Much of the spillway is less than five feet high, its forebay is small, and an unduly large section would have been required to resist a thrust resulting from expansion of an ice sheet against it. Therefore, a one-on-two batter was provided on the upstream face for five feet below the crest to reduce this possible ice pressure. On sections more than five feet high, maximum ice pressure, taken as 10,000 lb. per lin. ft., was assumed to act at elevation 1,358. Even with these provisions, a much heavier cross section than is usual was required.

WATERWAYS

Both of the Raft Lake cuts are located in soft, schisted green stone. The overburden is scanty, so that of the

Fig. 8—Raft lake east cut; wedge-shaped wave approaching the Raft lake spillway after blasting the Marmion lake "plug".

Fig. 9—Raft lake control works and spillway.

total of slightly over 500,000 cu. yd. of excavation required at these two points, rock accounted for nearly 96 per cent. The section adopted for these cuts is rectangular in shape, 100 ft. wide, with the invert on a level grade at elevation 1,340. For the east channel, this meant a maximum depth of cut of about 60 ft., while for the west channel the maximum depth is about 90 ft.

The esker at the south end of Finlayson lake rises to a maximum elevation of 1,475 and is about 1,500 ft. wide at the base, measuring from the lake on the north to the swamp on its south side. In order to pass the required amount of water at low stages in Marmion lake, it was necessary to set the invert of the channel at elevation 1,338. The maximum depth of cut was therefore 137 ft. Side slopes in earth were made 1 on 2, and the net bottom width of the earth section 180 ft.

The material above elevation 1,350 is a poorly graded sand and gravel mixture. Below this there occurs a fine sand, with such uniformly sized particles that it becomes "quick" when thoroughly wet. To prevent this material from being washed out, the cut was located to take advantage of sub-surface rock contours so that at least the inlet would be in non-erodible material and excavated rock was used to line the wetted perimeter of the remainder of the cut. This lining was carried up to elevation 1,354, the maximum water surface elevation at the assumed highest flows. To reduce excavation, the rock cut at the inlet was made 160 ft. wide with walls practically vertical.

In accordance with the basic design for the diversion, as outlined above, and also to provide suitable facilities for logging operations, a channel 300 ft. wide was cleared through the timber and underbrush in the swamp area between Wagita bay and the esker cut.

At the depression in the rock ridge through which the swamp drains into Wagita bay two dams were required, one about 500 ft. long with a maximum height of 14 ft., and the other about 700 ft. long with a maximum height of 30 ft.

The former of these is an earth dam, and was built to its full height, i.e., with crest at elevation 1,343. The top width is 10 ft., the upstream slope 1 on 3, and the downstream slope 1 on 2½. A cut-off is formed by a single row of Wakefield sheet piling. The longer dam is a standard, concrete, gravity-type bulkhead with a sluiceway to be closed by timber stop-logs. To allow the diverted river to flow into Wagita bay, a 100-ft. length of the bulkhead was built to elevation 1,325 only, to form a free overflow whenever the water rises above this height. The length and height of this section were fixed by the dual requirement of preventing flooding of near-by mining claims and of maintaining a low holding contour to the south.

To facilitate future completion of this bulkhead section, the sill of the sluiceway was placed at elevation 1,315, and the piers and approach bulkhead section built to full height. The sluice will pass all low water flows up to and including the average flow of the river, with the upstream water surface at elevation 1,325 or lower. Thus the structure can be completed during any future low water season without the necessity of unwatering.

THE NARROWS BULKHEADS

At the South Narrows bulkhead site, ledge rock outcrops at the southerly end only, the remainder of the foundation consisting of ledge rock overlaid with soft clay to a maximum depth of 18 ft. At the deepest point of the Narrows, the dam has a height of 60 ft., which makes it an outstanding structure of its type.

Where the foundation consists of exposed ledge, ordinary rock-filled timber cribs were used, with a blanket of suitable material deposited to form a seal at the upstream toe. For the remainder of the bulkhead, two parallel rows of steel sheet piling, spaced 30 ft. apart, were driven through the overburden to bed rock. One row of 1½ in. rods and turn-buckles, five feet below the top of the piling and spaced at intervals of five feet

Fig. 10—Earth excavation in progress at the esker cut.

Fig. 11—Esker cut nearing completion.

tie the two rows of sheet piling together, and double channels bolted to the piling act as wales. The space between the two rows of sheet piling was filled with gravel. Rock fill was placed against both the upstream and downstream faces of the bulkhead. This somewhat unusual design was selected because a minimum amount of steel was required—an important consideration in war-time. At the same time, it made full and effective use of the natural materials which the site abundantly provided.

The North Narrows bulkhead, only 30 ft. high at the maximum section consists of a gravel fill central portion flanked by rock fills. A single row of steel sheet piling driven through the gravel core forms a cut-off.

Construction Schedule

It was late in the winter of 1942-43 before the project had advanced to the stage where a general contract could be let. The goal set was the shipping of ore before the close of navigation in the fall of 1944. Such an accelerated programme meant that Steep Rock Lake must be sealed off and the diversion completed by mid-December 1943, to allow time for unwatering Steep Rock lake and for stripping the ore body. Despite the huge quantities of material to be excavated, this date of mid-December was actually met and pumping of Steep Rock lake commenced on December 15th, 1943.

Work got under way in the first part of April 1943, with the driving of a tunnel 350 ft. long by 10 by 12 ft. in cross-section under the esker to drain Finlayson lake. At the same time, excavation of the esker cut itself was commenced.

Construction of the initial stage of the Wagita Bay dam started in mid-May 1943. Obviously, it was necessary to complete this operation before the tunnel was holed through and water from Finlayson lake passed on to Steep Rock lake.

The two Raft lake cuts involved the excavation and disposal of over 500,000 cu. yd. of rock. Within the short time allowed by the schedule, this could only be done by working simultaneously from four faces. Since the volume of Raft lake down to the grade of the cuts was only 600 million gallons, this water was pumped out as an initial operation at this point. This allowed excavation from the Raft lake end of the two cuts to be done in the dry and proceed against a full working face. As explained above, it was required that Marmion lake be maintained at its normal elevation until the diversion was completed. It was therefore decided to follow a procedure at this point which had been successful twice before under similar circumstances. This called for leaving a rock barrier between the cut and Marmion lake, which barrier would be blown out as a final operation, with any loose rock not removed by the blast, excavated thereafter in the wet. It was therefore necessary to ramp down about 30 ft. at this point before a full working face could be developed. After the bulk of the water from Finlayson lake had been drained, it was possible to start a fourth face at the Finlayson lake end of the west cut. It was necessary to leave only a small barrier or "plug" here.

Special Construction Features

Construction methods and procedures were governed almost entirely by the time limitations which the construction schedule imposed. At Raft lake, standard well-drilling methods, using seven-inch holes spaced 20 ft. on centres and drilled five feet below final grade, were employed on the east cut while a diamond drilling method new to construction was used on the west cut. Here a shaft was sunk on the centre line at each end of the cut, and a drift seven feet square established between them with its invert three feet below grade. Vertical 1½ in. holes spaced ten feet on centres, in rows six feet apart, were drilled from the surface to within two feet of the top of the drift. Horizontal holes, at three feet centres, were drilled from the drift to the walls of the cut. These assured a level floor for mucking. The cut was advanced in 12-ft. slices, two rows of vertical holes and four horizontal holes being fired simultaneously. Views of typical surfaces produced by these two methods of excavation are shown in Figs. 5 and 6. The well-drilled cut has uneven, shattered walls, with about 15 per cent overbreak, whereas the diamond-drilled cut has extremely smooth walls and the overbreak amounted to only two per cent.

Before the diversion, Finlayson lake stood at elevation 1,396 and drained northward and eastward into Marmion lake. As part of the programme, therefore, it was necessary to lower this lake to about elevation 1,345, which would be its normal elevation after the diversion. Under ordinary procedure, the emptying of this lake would have been accomplished by making use of the esker cut after the latter had been completed. Because of unavoidable delays in getting construction

Fig. 12—Completed esker cut looking south.

Wagita Bay dam.

small and easily blasted. At the east end it was quite different. Here, a wall of solid rock over 30 ft. high and containing about 7,000 cu. yd. was of necessity left for the final break-through. The blowing of this "plug" was a very spectacular affair.

The South Narrows bulkhead was completed in one operation. At the smaller North Narrows bulkhead, an opening was left at the centre sufficiently large to pass the flow from the Moose Lake power plant.

At the beginning of October, the sluices at the Moose Lake dam were opened and Marmion lake drawn down sufficiently to allow placing the flashboards on the spillway. After this was done, the dam and power house intake were closed, the plant was shut down, the North Narrows bulkhead completed, and pumping started on December 15, 1943, as previously noted. The diversion itself was put into operation on January 26, 1944, the power plants downstream being supplied in the interval with water from Finlayson lake and from the Steep Rock lake pumps. Figure 7 shows the Marmion "plug" before blasting, Fig. 8, the first wedge-shaped wave approaching the Raft lake control works. Figure 9 shows water flowing over the control works and spillway shortly after the blowing of the Marmion "plug".

under way, the engineers of the mining company decided to try an alternative scheme which, if successful, would shorten, by several months, the time to complete the diversion itself.

This involved excavating a tunnel, 10 by 12 ft. in cross-section and 1,350 ft. long in the rock underlying the esker. The starting point was an outcrop on the southerly side of the esker and the tunnel was driven northward until a point under the lake bottom was reached. Here a shaft was stoped out until only a very few feet of rock was left. This latter was heavily loaded in the hope that the blast from the charge would clear a hole through the 21 feet of overburden which existed at this spot. Previously, two large sumps had been excavated in the tunnel, one near the foot of the shaft and the other near the outlet, to catch any large pieces of rock not thrown clear by the blast and so prevent them from blocking the tunnel. The operation was entirely successful, flow starting immediately after the charge was fired. Despite the heavy shot only a moderate "boil" appeared on the surface of the lake, which at this point was 36 ft. deep.

It was computed that flow through the tunnel, at the start, would be about 2,300 cu. ft. per sec. and that the level of Finlayson lake would drop about six inches per day. Actually the rate of flow was higher than this and the lake dropped about seven and one-half inches per day. In anticipation that control of the tunnel flow might be required, stop-log checks were formed in the rock near the outlet.

The drainage tunnel under the esker enabled Finlayson lake to be lowered almost to its final normal level. The "plug" left at the west end was therefore

The drainage tunnel at the esker passed the flow of the Seine river until the completion of the cut on April 26, 1944. Figures 10 and 11 show this cut under construction, and Fig. 12 the completed job.

Table II is a summary of total quantities of rock and earth excavated for the diversion. The bulk of this work was done between April and December 1943, a period of only nine months, and was entirely completed by April 1944.

TABLE II

Quantities of Earth and Rock Excavated for Seine River Diversion

	Rock Excavation Cu. Yd.	Earth Excavation Cu. Yd.
Wagita Bay Dams	500	600
Esker Cut	75,000	1,160,000
Marmion-Raft Cut	215,740	6,850
Raft-Finlayson Cut	259,540	15,000
Raft Lake Control Works and Forebay	31,540	2,000
	582,320	1,184,450

DIAMOND DRILLS AND WELL DRILLS ON THE RAFT LAKE CANALS AT STEEP ROCK

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The Raft Lake canals are part of the extensive Seine River diversion scheme (Fig. 1) carried out by Steep Rock Iron Mines Limited to enable them to pump Steep Rock Lake dry and mine the otherwise inaccessible high grade iron ore bodies known to exist in the lake bottom. The two canals have similar dimensions and they are in the same formation. The central section of the east cut was broken by well drill blasting supplemented by jackhammers and the central section of the west cut was broken by a method employing diamond drills and a pilot tunnel. Thus the physical setup was excellent for comparison of the two methods and many interesting differences were brought out during the course of the work which the author will endeavour to state fully in this paper.

All the work at Raft lake and the bulk of the other work at Esker cut, various dams, camps, and road construction was contracted to C. A. Pitts General Contractor Limited, under a very exacting time schedule. As far as the work at Raft Lake was concerned, the general contractor found that he had insufficient well drilling equipment to undertake both cuts at the same time and therefore, with the sanction of Steep Rock, he let a sub-contract for the drilling and blasting of the deep central section of the west cut to Boyles Bros. Drilling (Eastern) Limited who had suggested a diamond drilling method adapted from the underground method employed by several large Canadian mining companies.

General Conditions

Raft lake occupied a rock basin, about a quarter of a mile in diameter and 80 ft. deep, located in the centre of the ¾ mile rib of rock between Finlayson lake on the west and the Seine river (Marmion lake) on the east. In the spring of 1943, it was accessible only by water as it was situated in an undeveloped section of precambrian rock and muskeg, 16 miles north of Atikokan, Ontario (A station on the Canadian National Railway 142 miles west of Port Arthur). It was evident that only light drilling and stripping equipment could be moved in over the water route and this was done in May. The heavy trucks and shovels could not be placed on the job until a road had been constructed and that was not possible before August. As it turned out, blasting and excavation of the west cut could not have commenced before August because excavation was entirely dependent upon the dewatering of Raft lake and also upon the water level of Finlayson lake, neither of which were low enough before August to permit the establishment of ramps and starting faces at the ends. For this reason the hole spacing and method had to be chosen without trial on both cuts and most of the drilling was completed before blasting could begin.

The cuts on both sides of Raft lake were in solid greenstone or pillow lava with a distinct vertical slatey cleavage. One dike of harder diorite 50 ft. wide formed a high ridge on the west cut but all the rock may be considered good drilling for all classes of equipment. The rock surface was smooth and solid owing to glaciation but it was very hummocky on the west cut. The tops of the hummocks were bare rock somewhat decomposed to a depth of 4 or 5 ft. and the depressions were usually filled with hardpan, clay and muskeg to a depth of from 4 to 15 ft. Such potholes had to be excavated by dragline and by hand labour before the rock below could be drilled off.

The construction of access roads and ramps to four faces was a big job as was the lake pumping, stripping, and the preliminary work in establishing the four faces squared up to sufficient height to warrant either the well drill or diamond drill method. For the purpose of this paper, all these things will be considered as done, and detailed description will be confined to the central sections of the two cuts; but because the diamond drilling of blastholes is new to construction work and because this is the first cut to employ a diamond drilling method exclusively, a full description of the west cut will be given. Description of the well drill cut, on the other hand, will be brief as it followed methods that have been familiar to construction men throughout the country for many years.

The East or Well Drill Cut

General

The east cut was relatively flat on top with some shallow areas of muskeg and clay that had to be removed by dragline because they would not support

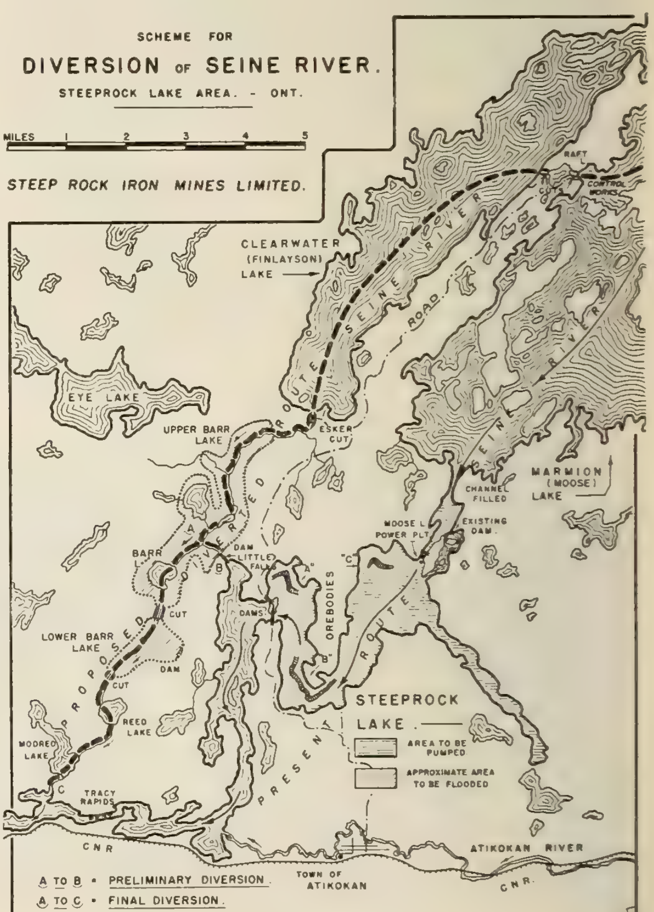

Fig. 1.

Fig. 2—The "Diamond Drill" Canal.

Fig. 3—The "Well Drill" Canal.

equipment. The east toe was submerged under Marmion lake and had to be left as a natural dam until it was blown out on completion of the job, but the relation of Marmion lake to grade was such that a face could be started by ramping down from just above water level until grade was reached and a light ¾-yd. shovel and two trucks were brought in on a scow to get this face started. A start could not be made on the Raft Lake No. 2 toe until the middle of August when Raft lake was almost down to grade and the well drill blasting was not under way there until September 1st.

During April and May 1943, Camp 5 was established on the east side of Raft lake to accommodate 250 men and was furnished with a bit sharpening shop for both well drills and jackhammers. The six well drill rigs, compressors, gas and oil and the pumps and pipe for dewatering Raft lake were all moved in at this time under very difficult tractor hauling conditions on the mile of muskeg road between the dock at Finlayson lake and the camp. The starting up cost of the well drilling was therefore quite high.

CHURN OR WELL DRILLING

Once the well drilling was under way it became a self-contained operation not subject to delays from outside sources. Drilling on the central section of the east cut started on May 26th and continued until September 10th during which 16,558 ft. of 7-in. hole was put down to an average depth of 58 ft. at an average rate of 16 ft. per ten-hour drill shift. The Keystone No. 26 Model 51 drills were all self propelled and crawler mounted and each valued at about $10,000 when new.

In well drilling operation, a heavy steel stem with a large chopping bit on the end, the whole thing weighing about a ton, is lifted and dropped in the hole on about a 30-in. stroke. The face of the bit is forged to a special design to clear cuttings and to maintain the gauge of the hole and is tempered and heat treated to withstand considerable abuse. The bits averaged about 12 ft. each sharpening and were taken to and from the job by a small service tractor pulling a stone boat. The drill rig is heavy and some side hill setups were difficult as a firm solid base had to be built up. A crew of two men tended each machine and would expect to drill from 10 to 30 ft. in a ten-hour shift for which one or two bits would be required.

BLASTING

Spacing and burden were both about 20 ft. and all holes were drilled 5 ft. below grade. Once a face was established it was not carried at right angles to the direction of the cut but rather at a skew to suit the direction of the vertical cleavage of the rock which made an angle of 60 deg. with the centre-line. (Cleavage N. 42° E., cut N. 78° W.). The corner holes on the tight side were left each time for the following shot. Seventy-five per cent polar forcite gelatin in 6 by 15 in. cartridges was loaded throughout and detonated with instantaneous electric blasting caps. The charge was not decked as it was found necessary to load a solid column to within 20 ft. of the top using a primary factor of 1.25 lb. per cu. yd. The holes were then filled with sand stemming. A one row shot would yield from 4,000 to 5,000 cu. yd. of broken rock in a loose wedge-shaped pile 25 ft. high near the face and tapering to nothing about 150 ft. away.

As the operation progressed it became evident that, although the rock was relatively easy to break, the bottom was very tight due to the formation being more or less slatey and standing on end,—and often failed to break to grade. This was a serious handicap because of the restricted working space and the demand for speed. Had there been other working faces there might have been time to drill snake holes in the face or do the necessary jackhammer trimming without holding up the mucking. As it was, a number of situations developed that caused delays to production and considerable secondary work.

Overbreak of 20.8 per cent at the walls was average for well drill blasting of this nature although payment was made for overbreak up to 12 per cent only. The walls themselves were rough, embayed and badly cracked in places, necessitating a substantial amount of scaling and jackhammer trimming.

The heavy loading of the holes together with the easy cleaving nature of the rock caused some backbreak although that in itself was no handicap, but sometimes wide cracks opened up 20 or 30 ft. behind the row blasted causing offset holes and difficult loading. On several occasions, cracks up to 12 inches in width opened right along the row of holes behind the shot and if this row happened to be cased through over-burden, parts of the holes might be filled and be difficult to clean and load.

The muck pile was a characteristic well drill product. In other words there was a considerable range in size from dust to large blocks in a big loose pile with the larger pieces usually resting on top where they could be readily blockholed. As the work progressed, more jackhammers and compressors were added and fragmentation was improved by "blockholing in the main shot." In other words the spaces between all the well drill holes were drilled off by jackhammers to a depth of 18 ft. on a 6 by 8 ft. pattern. This is considered to be secondary work in this paper.

SHOVELLING AND HAULING

The material was loaded by 2½ and 1½ cu. yd. Northwest diesel shovels into 15-ton Euclid trucks and was hauled an average distance of about 800 ft.

up ramps at both ends so that all the material was elevated a vertical distance of about 30 ft. The dumps were built out into Marmion lake and Raft lake and were kept in condition by bulldozers which were also used to clean up the scattered muck on the floor immediately after each blast. During part of the operation two shovels were used at one face, and sometimes at both faces, without much difficulty as the skew of the face and the overbreak gave a clear width of 120 ft. for swinging the shovels.

Production per shovel shift was poor especially during August when several lengthy idle periods were occasioned by the jackhammer work necessary on the floor of the cut after several shots had failed to break to grade. Even on the basis of actual operating time, production seldom exceeded a rate of 800 cu. yd. per ten-hour shift and, although this may be partially explained by the facts that the equipment was not as new nor the operators quite as skillful as those employed in the west cut, it was also due in some measure to the blockholing of big muck and the necessity of working around occasional big pieces buried in the pile.

The West or "Diamond Drill" Cut

General

The surface of the west cut was more rugged than that of the east cut as it consisted of a series of rounded rock hummocks with muskeg potholes between them which were sometimes 15 ft. in depth. The excavation of the muck from these potholes was a costly job for the light dragline equipment that could be brought in via the water route, and when they were cleaned out it became evident that a lot of staging would be required for drilling on the many steep side hills. For instance, the highest hump, where the cut depth was to be 90 ft., dropped off 40 ft. on both sides with slopes of 45 to 60 deg. (Figs. 4 and 5).

The toes on both the Raft Lake and Finlayson Lake ends were entirely submerged to cut depths of 56 and 58 ft. respectively when the job started in May. The east toe was blasted on August 15th and the first shot on the central section August 26th. The west toe was blasted on September 5th, but the first shot on the central section was not fired until October 15th because of a series of blasting, ramp and water seepage difficulties unrelated to work on the central section. The east and west faces were known as No. 3 and No. 4 respectively.

Finlayson lake became clear of ice on May 11th and immediately six gasoline powered diamond drill outfits were moved by scow and tractor to the site of the cut. A tent was erected for temporary accommodation of the men prior to construction of Camp 6, and a 12 by 26 ft. storage and repair shop was established near the work. Drilling commenced on May 19th and continued until October 24th, during which 171,253 ft. of 1½ in. (E) hole was completed on the central section at an average rate of 112 ft. a ten-hour drill shift. Ten Boyles Bros. Model BBS—1 diamond drills powered with air-cooled Wisconsin gasoline engines were employed during the first two months but when compressed air was made available in July, a change was made to Boyles Bros. J V underground type drills. The gasoline drill is valued at about $1,425 and has a hoist and cable with which to pull itself about on long moves. The J. V is valued at about $1,000, has no hoist but is very light and easily moved.

The Sub-Contract

The diamond drilling and blasting on the west cut was done for 75c a cubic yard on a fixed price sub-

Fig. 4—Muskeg pothole and highest hump.

Fig. 5—Same view as above showing drills and staging.

contract basis by Boyles Bros. Drilling (Eastern) Ltd. for C. A. Pitts General Contractor Limited under the following contract terms.

In general, the work was to be carried out according to the terms of the pre-existing agreement between the general contractor and Steep Rock Iron Mines Limited based on the completion date, October 31st, 1944. The cut was to be 100 ft. wide with vertical side walls although overbreak up to 12 per cent beyond these limits was to be allowed and paid for.

The subcontractor agreed to drill off, blast and break approximately 245,000 cu. yd. of rock from the proposed canal and perform such secondary drilling or blasting as was required to render the rock muck to a size that could be economically and efficiently loaded by the shovels (2½ cu yd.) into the trucks (15 ton) that were available for the work, but normally no one piece of rock was to be of a greater size than 40 cu. ft. The work was to be under the direction of the general superintendent of the general contractor and was to be planned to suit the progress schedules established from time to time.

The general contractor agreed to furnish camps, board and transportation on the same basis as was provided for and charged to their own employees. He also agreed to supply compressed air and water under pressure to the drill sites for operation of the drills, squared timber for staging, stripping of overburden from the rock surface, lights at night, transportation of men and equipment to and from the railhead at Atikokan and the necessary underground openings required by the method adopted.

It was understood that the diamond drilling yardage contract would apply only after the toes on both ends had been excavated by the general contractor to vertical faces more than 40 ft. in height.

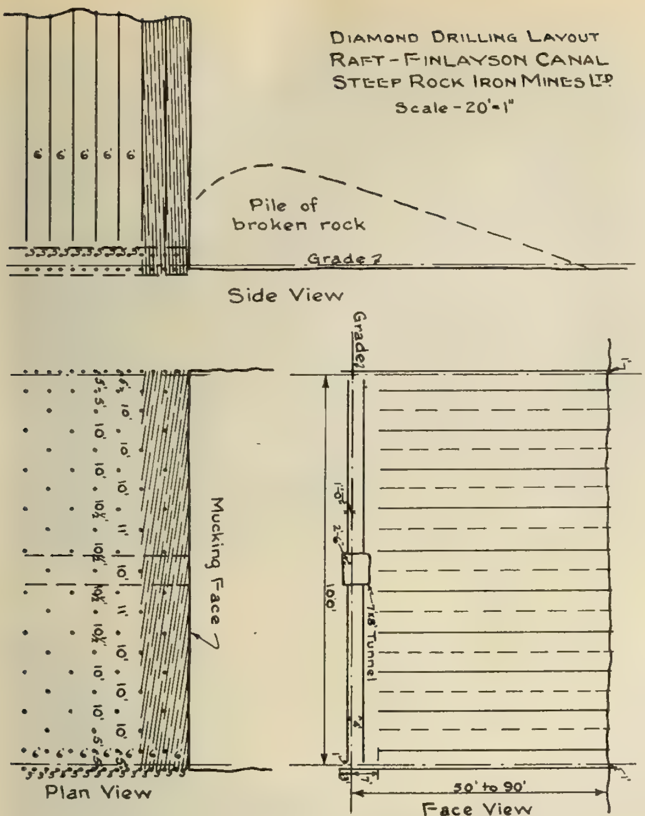

Fig. 6—Drilling and blasting layout.

THE LAYOUT

The layout for drilling and blasting is shown in Fig. 6 and was based on the fact that excellent results had been experienced at a number of mines through the use of long diamond drill holes and wide free faces. The broken material in such cases is removed through previously established draw holes below the block and in preparing these draw holes the block is usually undercut beforehand from one end to the other. The use of 1½ in. holes with a 6-ft. burden and 10-ft. spacing is fairly common and gives good fragmentation but it was evident that such a spacing would not break a solid bottom but would "bootleg" unless an undercut or some other means was provided to relieve this "tight" section. The means adopted for the west cut consisted of a 7 ft. x 8 ft. pilot tunnel driven through the centre of the cut with the floor 2 ft. 6 in. below grade. This provided a convenient and safe working place from which to drill closely spaced horizontal diamond drill holes near and immediately below grade elevation such that, when these were blasted at the same instant as the related vertical holes, the shot would surely break to grade and in addition form a level mucking floor. Normally such a tunnel could be driven from one or both ends but in this case both ends were submerged under more than 50 ft. of water and, in order to have the work proceed at the same time as the Raft Lake pumping, it was necessary to sink two small shafts to a depth of 70 ft. and drive the tunnel from these at considerable extra expense. The work on the shafts and tunnel was expeditiously carried out by Patrick Harrison between May 15th and August 26th.

The face of the west cut was carried at right angles to the centre-line although the direction of the vertical cleavage actually was at an angle of 82 deg. to it (cleavage N. 42° E., cut N. 56° W.) but the small difference between the direction of the face and the direction of the formation caused very little trouble.

DIAMOND DRILLING

During May, June and July, drilling proceeded on the surface with the B.B.S.—1 gasoline drills and thereafter until the end of the job with the air powered J.V. type machines. Underground drilling commenced early in August and required air powered drills only. Compressed air was supplied by the general contractor from a centrally located bank of Ingersoll-Rand and Sullivan semi-portable compressors capable of delivering 3,500 cu. ft. of free air per minute. Water at 75 to 100 lb. pressure was easily supplied by small units at the beginning of the job because the lake levels were high and the drilling started at the water's edge. Later when 50 gal. a minute was required at 100 lb. pressure against an 80-ft. head, a triplex pump known as a Rex Road Pump was installed and proved very efficient. The constantly changing levels of Raft and Finlayson lakes, however, required that the pump setup be adjusted from time to time and this proved to be a minor source of difficulty on account of the rugged shoreline.

All the drills used on surface were mounted on rigid frames which in turn were mounted on pairs of 4 by 6 in. wooden runners about 10 ft. in length. These runners would rest across pairs of level squared timber sills laid parallel to the direction of the cut. A six-man timber crew laid the sills solidly and accurately ahead of the drill crew and marked the hole locations in order that moving, levelling and starting up time could be reduced to a minimum. Usually three, but sometimes six holes could be drilled from one pair of 18-ft. sills. Accurate locations were marked at intervals by the Steep Rock surveyors and hole depths were chalked on the timber sills. Every effort was made to line up the holes in straight rows in order to avoid blasting complications as much as possible.

The drilling operation is essentially a matter of tending a machine which rotates a bit set with diamonds against the rock and feeds the bit ahead under pressure to keep it cutting. The bit is followed by a reaming shell also set with diamonds to maintain the hole accurately to gauge. The bit and shell combination is screwed on the end of a string of hollow drill rods having threaded joints every 5 or 10 ft. Water is forced through the rods for the dual purpose of keeping the bit cool and removing the cuttings as sludge. The sludge makes its way up the hole between the outside of the rods and the rock wall of the hole.

Placing the equipment on the job and getting started offered no particular problem as all the items of equipment weighed less than 300 lb. with the exception of the gasoline drills which weighed 900 lb. each but which were self propelled if desired. Five truckloads of gear were taken from Atikokan ten miles by road to the south end of Finlayson lake where it was loaded on a scow and taken six miles up the lake to a landing dock. Tractors pulling stoneboats over a half mile of muddy road put the gear on the site of the cut.

Setups, particularly on side hills, depended on a good, solid and safe staging of 8 by 8 timbers on posts that were occasionally set in hitches cut in the rock with a jackhammer. The machines were tied down solidly to an eyebolt set in the rock by means of chains about the frame made tight with a turnbuckle. Machines were skidded from hole to hole with crowbars and elevated from one set of timbers to a higher set by using the hoist on the gas machine to pull it up an inclined plane or by manual lifting in the case of the air machines.

Where the rock was bare and solid, no pipe casing was required at the collars but in fractured areas and through the hardpan left in the bottoms of the pot-

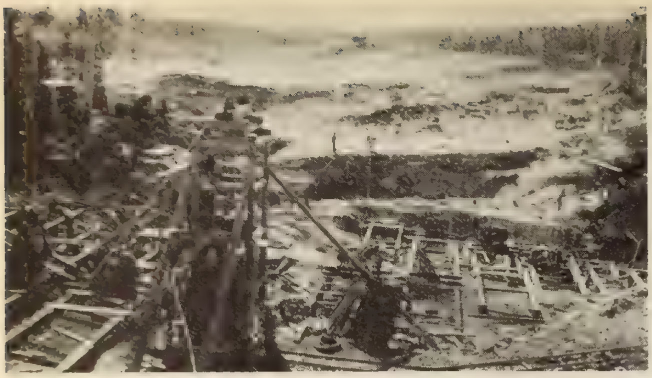

Fig. 7—General view of surface drilling.

Fig. 8—Same view as above after excavation started.

holes 1½-in. pipe collars were set a foot or two into solid rock. On sidehills where setups might be as much as 15 ft. above the rock, long pipes were set to help reduce vibration in the string of drill rods.

As two or three moves were commonly made in a shift, it was not convenient to have any shelter over the drills and during wet weather the crew wore rubber overalls, coats and sou'wester hats. It must be remarked that such an operation would be slowed up considerably by winter weather because heated shelters would have to be made as well as provision for coil stoves to keep the water supply line from freezing.

The underground portion of the drilling was carried out under much better operating conditions than those mentioned in the preceding paragraphs. Each setup was identical with the one before it, and consisted simply of a 6-ft. mine bar set vertically in the centre of the tunnel to which the J.V. air drill was clamped. There was no need for timber staging, eyebolt holes or casing, the labour requirement was very much reduced in comparison, and the crew was sheltered from variable weather conditions. These advantages were reflected in the fact that the total cost of underground drilling was roughly 20c per ft. less than the surface drilling. The only important problem that developed underground was due to inadequate or broken pumping equipment as the tunnel, being 2 to 3 ft. below cut grade, acted as a sump and would be flooded after a heavy rain. Normal drainage into the shaft sump was from 50 to 100 gal. per min.

The bulk of the drilling was carried out with a non-coring concave type blasthole bit set with about 300 diamond borts having a total weight of about 6 karats valued at $4.00 per karat. Average per bit was 62 ft., average per ten-hour drill shift was 112 ft. and per manshift 50 ft. Some exceptionally high drill shifts were reported and the record on surface was 212 ft. and underground 237 ft. The emphasis on this job was on footage, encouraged by a footage bonus, although this tended toward a considerably poorer bit performance and consequent diamond cost than would be expected on a similar job not rushed. Vibration was the chief problem encountered in the drilling and it was not eliminated throughout the job. At any depth after 30 ft. the rods might start to slap from side to side in the hole, sometimes violently enough to stall the machine, and although all varieties of rod grease, gear dope, cable dressing and axle grease were used on the rods in an effort to reduce vibration none had a lasting effect. A possible remedy might have been the use of special heavy blasthole rods of a diameter more closely approaching full hole size but delivery of such tubing could not be expected during the life of the job and therefore a trial was not possible.

BLASTING

The main features of the method were the use of small diameter, extra long holes widely spaced and the establishment of a pilot tunnel or drilling drift through the centre of the cut 2½ ft. below grade from which horizontal holes were drilled to the walls. In other words the widely spaced vertical holes would break to the wide free face but not to bottom and in order to avoid springing long holes and to ensure breaking perfectly to grade, closely spaced lifters were employed. The lifters had to be drilled from a tunnel as there was only a 100-ft. width of face and mucking had to be continuous there. Had there been more working face it might have been economic to have used standard lifters in the face drilled with jackhammers or a wagon drill.

The layout was as shown in Fig. 6. The spacing of 10 ft. and burden of 6 ft. were established by experience at various mines and proved satisfactory for this ground but, as most of the cut was drilled off before blasting could begin, it must be recognized that good fortune played a major part. Holes were placed at 3-ft. intervals along the boundary rows until blasting results proved they were unnecessary in this ground. The boundary rows were drilled one foot outside the theoretical limit to allow for a possible deviation inward of some of the holes because the specifications called for a cut 100 ft. in width at the bottom.

From a blasting standpoint it is preferable to blast one complete 6-ft. slice at a time from a given face, and this is commonly done in mine work, but one row shooting would throw down too small a muck pile for a good shovelling and loading schedule and therefore a two row shot was adopted. A two row shot would place from 2,500 to 4,000 cu. yd. of broken rock in front of the shovel every blast, depending upon the height of the face. The two rows of vertical surface holes at 6-ft. burden and four rows of horizontal underground holes

Fig. 9—General view of west cut looking across Raft Lake.

Fig. 10—Face of west cut immediately before a blast.

Fig. 11.—Face of west cut immediately after a blast.

up work as it became apparent that the bootlegged horizontal holes were easy to find, clean out and reblast. Thus it will be seen that the need for a jackhammer crew was practically eliminated on this portion of the cut.

After a shot was fired a seven-man crew would start preparing the next one. The tops of the holes would be tested with an 18-ft. loading stick to determine if they were clear. Generally if any shifting had taken place it would be at flat weathered joints a few feet below the top in the front row of holes. If displacement was slight, an E chopping bit on X-ray rods was used with hand wrenches to clear it, but if the ground had shifted too much for that, the tops of such holes were loaded ready to be blasted at the same time as the sandblasting of the muckpile. A four-man surface crew would then proceed with the blowing out of the clear holes and a three-man crew would go underground to blow out and load as many holes as they could behind the muckpile. Generally, most of the holes were clear although four or five might require the use of the chopping bit. If they required to have their tops blasted off the resulting muck was shovelled over the edge until the collars were relocated on a flat bench a few feet below the top. The men wore safety belts for work of this nature.

The surface holes were then loaded by dropping one cartridge of dynamite at a time, listening to make sure that it

at 3-ft. burden, a total of 45 holes, were fired instantaneously with a 3A blasting machine and No. 8 electric blasting caps. Polar forcite gelatin 75 per cent in 1¼ by 8 in. cartridges was used throughout because of its concentrated strength and shattering action.

The effect of the blast was to kick off the face and shatter it without any lifting to cause overbreak or backbreak. The broken rock would fall into a pile about 30 ft. high 20 ft. out from the centre of the face and slope off to the sides and to grade about 100 ft. from the face. The little rock that was thrown beyond the 100-ft. line was quickly cleared up with a bulldozer. Little secondary breaking was necessary and was confined to sandblasting. The walls and face were commonly clear of loose rock requiring scaling, except along the top edge, as there was a marked tendency to break cleanly from hole to hole in a straight row and often the powder burn mark of every face and wall hole could be seen from top to bottom. The horizontal holes invariably broke to grade and made a level mucking floor across the central section. However, in one bottom corner out of four, small toes would be left about 12 ft. high and 6 ft. out from the wall. These proved worrisome at first but to prevent delays they were usually ignored and the cut advanced leaving the toe along the wall until a convenient time permitted the whole thing to be cleaned up. Very little time was involved in this clean

went to the bottom, and tamping every ten cartridges with a multiple loading stick made in 5-ft. sections which were first bored and slotted and then threaded on a sash cord. The front row was loaded with a solid column of dynamite to about 3 ft. from the top and the primer was placed second cartridge from the top. The back row was loaded solid to 10 ft. from the top and then alternately with 12-in. wood spacers and cartridges of dynamite to 3 ft. from the top with the primer placed second cartridge from the top of the solid loading. The spacers were used to keep backbreak and shifting to a minimum. All the holes were then filled to the top with sand stemming.

The underground holes gave comparatively little trouble. A bulkhead was used to prevent the muck from falling back into the tunnel and to prevent the shovel from pushing more in. While the shovel was mucking, the three men would clean and load about 10 of the 16 holes solidly to about 5 ft. from the collar, placing the primer second cartridge from the collar and filling the rest of the hole with clay stemming wrapped in paper. The shovel would advance first in the centre of the face to clear the tunnel and the loading crew could then hand muck the bottom, move back the bulkhead and clean and load the front holes while the shovel was cleaning the corners. In this way the shot was commonly loaded, connected and ready to fire as soon as the shovel finished mucking.

SHOVELLING AND HAULING

The average haul of 800 ft. and the building of the dumps at both ends to an elevation of 20 to 50 ft. above grade was practically identical to the set-up on the east cut. 2½-cu. yd. No. 80 D Northwest shovels did the bulk of the work and one shovel operating in a face proved much more efficient than two shovels. Three and sometimes four 15-ton Euclid trucks were provided to dispose of the muck from each shovel and these did excellent work especially in hauling full loads up the very steep (20 per cent) ramp at the west end.

Fig. 12—West canal completed; Finlayson Lake in the background.

The muck pile was usually well broken. A few shots required no secondary breaking at all but, on the average, about 250 lb. of 75 per cent forcite was employed in sandblasting each two row shot. However, as the shovel worked in close to the face it often happened that sections of ground had broken into flat slabs which nested together vertically and caused some bucking of the shovel.

The capacity of one shovel adequately supplied with trucks was close to 1,000 cu. yd. per ten-hour shift and this was often reached. By reference to the table of comparative data it will be seen that the shovel production per shift for the best month including all lost time was 901 cu. yd. on the west cut and 662 cu. yd. on the east cut. Similarly the overall average of 770 cu. yd. per shift on the west cut compares with 570 cu. yd. on the east cut. This marked difference in mucking efficiency together with the big difference in overbreak yardage combine to make the speed greater and cost of excavation less by the diamond drilling method than by the well drilling method. For example, a calculation of the mucking shifts that would be required to excavate the west cut by each method is as follows:

(a) By well drill method:

$$\frac{201{,}914}{570} \times \frac{120.8}{100} = 428 \text{ shifts}$$

(b) By diamond drill method:

$$\frac{201{,}914}{770} \times \frac{104}{100} = 273 \text{ shifts}$$

In other words the rate of operation in this case may be said to be 36 per cent faster for the diamond drill method or 57 per cent slower for the well drill method. It would appear reasonable that such a big difference in speed would be reflected in overhead charges as well as in rentals of equipment and other direct operating costs. The differences in this instance, however, are probably greater than would be expected on other jobs of a similar nature.

The above high speed on the west cut is explained by the fact that, during the excavation of the 210,000 cu. yd. central section, delays were relatively infrequent, particularly during August, September and October on No. 3 face. In the final six weeks, after No. 4 face had been opened up and the weather became severe, more serious delays were occasioned by rain storms, blizzards, and water seepage. An analysis of the major delays is as follows:

Nature of Delay	*Lost Shovel Hours*
Shifted holes	9
Backbreak on a hummock	7
Snow blizzard, no loading	10
Passing through clay filled depressions	34
Elimination of toes	38
Experiment with 3 row shot at shaft	17
Heavy rainstorms and broken pumps	80
Shovel breakdowns and repairs	75
	270

The major delays above account for 10 per cent of possible operating time. Other factors influencing shovel efficiency were shortage of trucks, absence of bulldozer from dump or during cleanup of a shot, moving in and out for both primary and secondary blasting, large blocks buried in the muck pile and the skill of the shovel operators.

SAFETY

No injuries of a permanent nature were suffered by the crew during the course of the work. The seven short term compensation accidents consisted of a bruised elbow when cranking an engine, two dislocated knees from falls, burns due to friction when clothing caught in a machine, burns about face from a flash in the carbide storage house, a wrenched back from lifting and a finger cut on a sharp edge of rock.

Conclusions

The diamond drilling method compares favourably with the well drilling method in speed of operation, in resulting condition of the canal and in cost at the Raft Lake cuts at Steep Rock.

The rate of advance through a cut was appreciably greater with the diamond drilling method because of the absence of overbreak yardage to be handled, relative elimination of delays for toe and floor trimming to grade, and better floor and muckpile for shovelling. The combined advantage in speed at Raft lake, on a basis of footage or equivalent cut completed, was approximately 36 per cent. A closer spacing of the well drill pattern would undoubtedly have reduced this big difference in speed and might reduce it to as little as 17 per cent which is the advantage in overbreak only.

The condition of the completed canals is markedly in favour of the diamond drilling method as the walls of the water channel are straight from one end of the cut to the other and roughness can only be measured in inches whereas, in the well drill cut, embayments up to 10 ft. in depth are commonplace and reduce the hydraulic properties or capacity of the channel through the development of eddy currents. Good walls are a characteristic result of the diamond drilling method as no special pains need be taken with the blasting and this feature may prove useful to hydraulic engineers in special instances to eliminate a tedious job of careful blasting or an expensive concrete wall.

The cost basis that best expresses the ultimate cost of a canal is total cost per cu. yd. within the specified limits (i.e., per pay yard) and not total cost per cu. yd. broken. In this manner, overbreak is shown in its true light as a costly thing (although on a purely rock breaking job, overbreak may be an advantage and then the cost per cu. yd. broken would be used). In the case of the Raft Lake cuts, the total cost per cu. yd. within the limits has been estimated to have been 10 per cent higher on the well drill section. Unfortunately, details of cost cannot be published, but it is interesting to note than only 3 per cent of all direct charges for breaking on the diamond drill cut were for secondary work compared with 30 per cent on the well drill cut. The other important differences in the cost column are that the diamond drill method required major expenditures for shafts and tunnel, compressed air and water supply, and the well drill method required a bit sharpening shop and double the amount of explosives per cu. yd.

The theoretical principle that creates the above favourable picture for the diamond drilling method is scientific distribution of powder in many long holes of smooth bore. Each stick of powder may be said to have its appointed task and no other, whereas in the well drill method, the heavy concentrated charge required to shear off to grade is entirely too heavy for breaking only and its force is wasted in the heaving effect that produces a shaken condition of the walls and resulting backbreak and overbreak.

The conclusions herein expressed apply only to rock conditions similar to those at the Raft Lake canals. Diamond drilling methods are not applicable to a great many formations or conditions where the well drills would find no trouble at all. On the other hand the diamond drills have such unique advantages for certain special rock breaking problems that an expanding future for them in construction work can be foreseen. Generally speaking, the ground should be solid and relatively free from open cracks, badly fractured areas, or a tendency for any part of the walls of the holes to cave. Bouldery overburden may prevent drilling from surface but the possibility of drilling entirely from underground might prove economic as that would eliminate work in the overburden altogether. When it is borne in mind that holes may be drilled to any practical depth at any angle-flat, up or down, it is evident that a diamond drilling layout could be made for any size or shape of cut. For example, a highway cut 200 ft. long and 25 ft. deep might be drilled off with nearly horizontal holes from setups at grade at each end. The method employed at Steep Rock would show up to best advantage on a face 200 ft. wide and 100 ft. high but its use would not be competitive where the depth was less than 40 ft.

RAFT LAKE CANALS AT STEEP ROCK

COMPARATIVE DATA

	West Cut Diamond drill section only	East Cut Well drill section only
General:		
Length	882′	883′
Depth, maximum	90′	64′
Depth, average	62′	51′
Width specified to vertical limits	100′	100′
Width broken	100′-104′	100′-140′
Cubic yards, theoretical	201, 914	167, 300
Cubic yards, broken	209, 979	202, 000
Overbreak percent	4.0%	20.8%
Drilling:		
Size and footage of holes drilled	1½″ diam.—171,253′	7″ diam.—16,558′
Cu. yd. (theoretical) per ft. of hole	1.18	10.12
Rate of drilling per 10-hr. drill shift	112′	16′
Average footage per bit	62′	12′
Approximate cost of one sharp bit	$15.00	$5.00
Blasting:		
Type of explosive	75% Polar forcite gelatin	75% Polar forcite gelatin
Size cartridge	1¼″ x 8″	6″ x 15″
Pounds per theor. cu. yd. primary	0.72 incl. shafts and tunnel	1.25
Pounds per theor. cu. yd. secondary	0.08	0.21
Secondary work approx.	1.5% of all costs	10% of all costs
Shovelling, Hauling and Dumping:	(2½-cu. yd. Northwest shovels	and 15-ton Euclid trucks)
Full capacity of 10-hr. shovel shift	1,000 cu. yd.	1,000 cu. yd.
Performance per shovel shift including all lost time—		
Best month	901 or 90% capacity	662 or 66% capacity
Complete job	770 or 77% capacity	570 or 57% capacity

IRON ORE LOADING DOCK AT PORT ARTHUR

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Paper to be presented at the Fifty-Ninth Annual Professional Meeting of The Engineering Institute of Canada, in Winnipeg, Man., on February 7th, 1945

The development of the Steep Rock iron mining project includes, as an important part, the means of transporting the ore from the loading point at the mine to the market at the lower lake terminals. Very early in the development, the Canadian National Railways serving the mining area at Atikokan were asked to consider the transportation problems involved, determine the facilities required, and establish the rates to be paid for such facilities.

In general, the facilities required included a spur track connecting the mine loading point with the main line at Atikokan, a distance of about four miles and including the yard tracks at the loading point for the storage of empty and loaded ore cars; providing ore cars of special design and sufficient quantity to handle the expected volume; improvement to main line track between Atikokan and Port Arthur, a distance of 140 miles; and providing ore loading facilities at the Lakehead sufficient for the rapid transfer of iron ore from cars to ore carriers for shipment down the Great Lakes to the lower lake ore terminals. After considerable discussion and study, arrangements were completed between the Steep Rock Iron Mines Co. Ltd. and the Canadian National Railways, with assistance in financing from the Federal Government, to proceed with the building of the transportation facilities required and preliminary work on the planning was commenced in the fall of 1942.

General Requirements

A survey of the ore and other material loading docks in operation on the Great Lakes was made to discover the possibilities of the various docks for this particular application. The high level pocket type ore loading dock is used almost exclusively in United States lake ports for loading iron ore from railway cars to boats and is a development from the very early days of the movement of iron ore from the Mesabi range in Minnesota through Duluth and Superior. However, another type of loading dock using belt conveyors has been developed in recent years for loading iron ore, limestone and other coarse materials and this type was thoroughly investigated and considered for the Port Arthur dock.

The annual volume of shipments from the Steep Rock Mine is expected to reach two million tons during the season of navigation of 200 days. This amounts to one average ore carrier load of 10,000 tons per day during the season. Because of weather conditions causing delay in navigation and other conditions of traffic it would be quite possible to have three ore carriers arrive for loads during one day; also some grades of ore must be stored for a time until a full boat-load is available. It is not desirable or economical to store any great amount of ore in railway cars and it was, therefore, assumed that a minimum ore storage at the dock of 30,000 tons should be provided. The average loading time on American iron ore pocket docks is about two hours for a 10,000 ton cargo. Actually, record shipments of about 17,000 tons have been loaded out to one carrier in twenty minutes. The Port Arthur dock, therefore, should have a reasonably rapid loading rate in order that cargo arrangements for shipments can be made at favourable rates in competition with the American iron ore ports. Steep Rock iron ore is fairly heavy and is expected to run from 135 to 150 lb. per cu. ft. as shipped and will be abrasive, particularly the larger size lump grades. The ore will be graded into three sizes up to nine inch and will also be graded according to analysis. It is expected that at least six grades will be shipped at first and, as development of the mine proceeds, more grades will be marketed. To provide uniform grading of a cargo of iron ore each carload will be sampled at the mine and graded while the cars are in transit to the Lakehead. These cars will then be placed at the dock in accordance with the grades to provide an average sample in the five or six cars emptied into each bin. When the bins are loaded into the ore carrier, further mixing of different bins will be made through each hatchway in the boat to ensure a good average sample in the whole cargo.

In general, therefore, the dock facilities to be provided should conform to the following conditions:

(a) To handle an annual volume of 2,000,000 long tons of iron ore with provision for future expansion if required
(b) To provide storage of a minimum of 30,000 long tons of iron ore ready for loading to boats exclusive of storage in cars
(c) To provide facilities for mixing the ore as graded when unloaded from cars into bins and from the bins into a boat
(d) To provide rapid loading of boats consistent with present American practice.

The high level pocket type iron ore dock in use at American lake ports meets all these conditions fully but because of the cost of this type of dock, particularly when the railway approach is such a large factor, it was necessary to make comparisons of the capital and operating cost for such a dock with other types to determine whether the high level pocket type would be justified for this application.

Comparison of Types of Docks

Preliminary designs and estimates were prepared on several selected sites for two main types of docks, one a high level type similar to American practice, the other a mechanical dock. The mechanical dock considered contemplated the use of belt conveyors for unloading the iron ore from cars to stock pile bins built on the ground and removing same from the bins with belt conveyors in tunnels to loading points at the mooring dock. The arrangement had the same storage capacity in the bins of 30,000 tons and the delivery to boats at two points at a maximum rate of 4,800 tons per hour. It was estimated that five hours would be the maximum loading time for a 10,000 ton cargo, the average rate of loading being much less than the maximum due to the shifting of conveyor mechanisms and the moving of the boat as each hatch was loaded.

After these studies were completed the general result obtained showed that a mechanical dock complete with railway connections would cost about 70 per cent of the cost of the high level pocket type complete with high level railway connection. The estimates for operating cost showed a marked difference, the mechanical dock

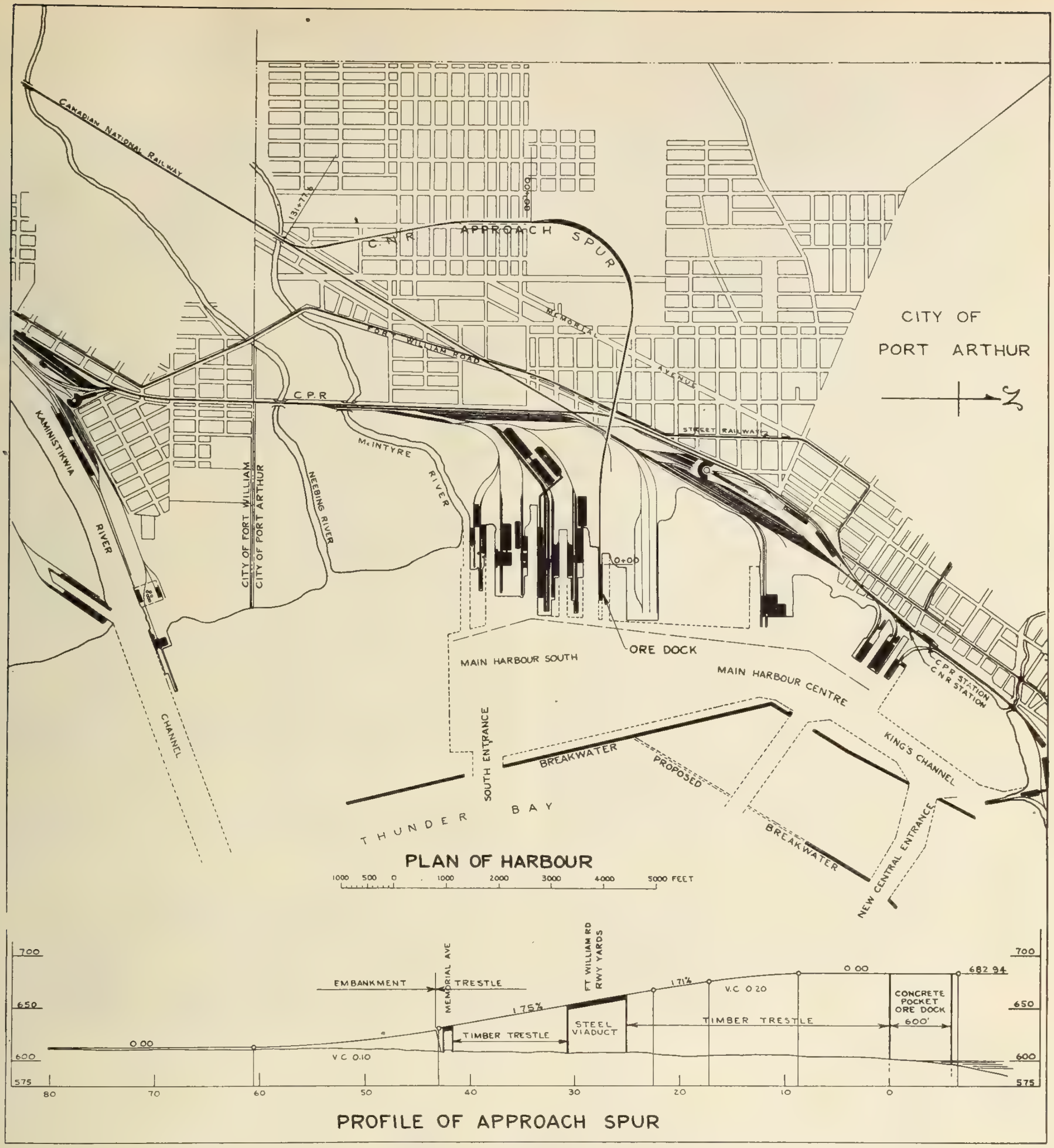


Fig. 1—Map showing location of approach spur track and ore dock.

being 2½ times greater than the pocket type. The pocket type being entirely a gravity method, there is very little wear and tear in equipment whereas the mechanical dock has a great amount of costly equipment requiring frequent replacements. There are some serious difficulties in the layout and operation of a mechanical dock, and two of the main ones are the large amount of shore property required for stock pile bins particularly if future expansion is to be provided, and a serious operating difficulty is the loss of time in loading a boat if mechanical breakdown occurs. This would happen much more often in the mechanical dock than in the pocket dock. The results of the investigation showed that if a volume of over 1,000,000 tons per year was shipped the overall cost was in favour of the high level pocket type dock.

All railway trackage in the Lakehead area is at a low level, usually a few feet above Lake Superior. The high level approach to a pocket dock would be required to reach a height of about 80 ft. above lake level. Where main line and yard trackage is at a comparatively low level and there is no high ground present close to harbour area, the cost of a high level railway approach is a considerable factor and this operates to the disadvantage of the high level type dock in comparative estimates with other types where a low level trackage throughout is used. There is no question in American practice that the high level pocket dock is entirely satisfactory and more economical than any other type for volume shipments of iron ore and the single factor at the Lakehead of the high cost of railway approach to the dock made it necessary to carefully study comparative estimates in the two types to be sure that the proper decision was made.

Choice of Site

Various sites were considered in the harbours of Port Arthur and Fort William before a selection was made.

The site question was included in the comparative estimates made in the two types of dock to determine the most economical type of dock and site. The general requirements of a suitable site included the following:

(a) Reasonably good foundation conditions must be obtained to permit use of bearing piles as the load per sq. ft. of dock structure is about 2½ tons.

(b) The site should have good access to C.N.R. trackage and yards to provide good operating approach facilities

(c) Proper navigation conditions to and from the site through the harbour should be available

(d) The site should have future expansion possibilities both as to the dock for increased storage of ore and loading facilities and railway connections for increased traffic

(e) The site should have access to both sides of the dock for berthing the boats

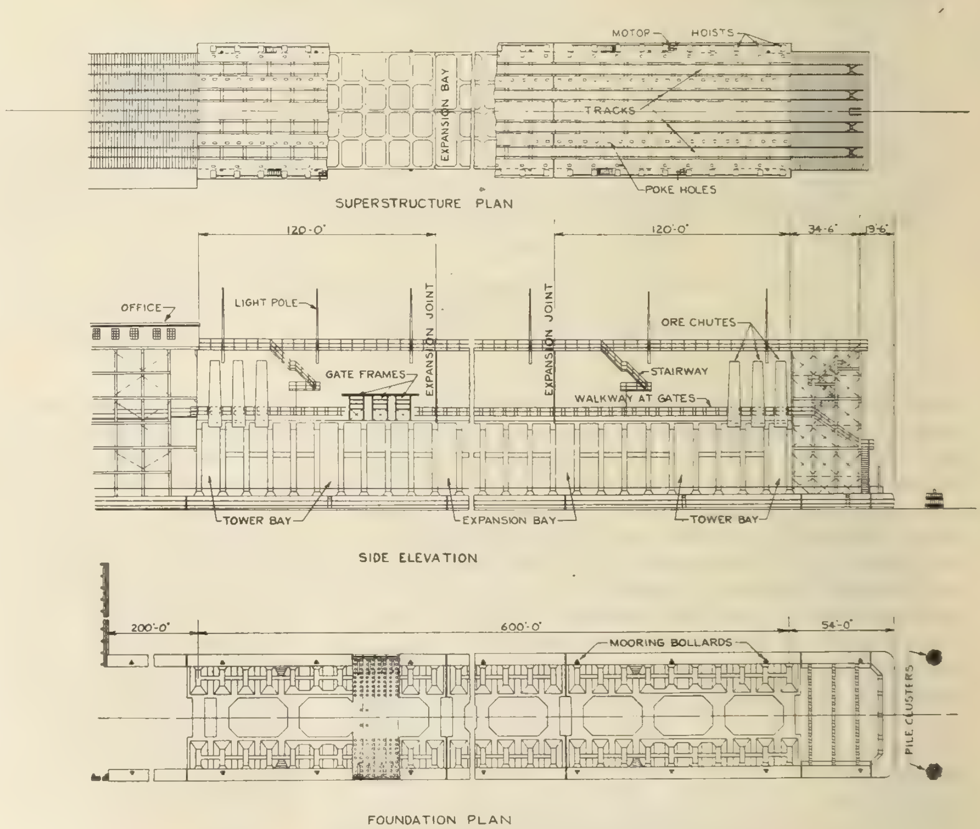
Existing traffic on the railway, particularly in the movement of grain traffic was taken into account in order that new traffic problems could be avoided as far as possible when iron ore shipments in volume were going on at the same time as maximum grain shipments. It was considered essential that loading of boats should be done on both sides of the ore loading dock to permit quick dispatch at times when boat traffic tie-ups occur and to handle larger volumes in the future if required. In the case of the high level pocket type dock the one-sided type has never been built and it is much more costly per ton of storage capacity than the two-sided dock. All sites considered, therefore, were limited to those which provided berthing of boats on both sides.

The preliminary surveys and investigation were completed and decision was made by the railway company in December 1943, to proceed with the high level pocket type ore dock with high level approach spur track on a site in the south harbour of Port Arthur. Figure 1 shows a map of the area with the location and profile of the approach spur track and the location of the ore dock in the south harbour area illustrated thereon. This site met all conditions required very well. Solid rock to support bearing piles was located 35 to 40 ft. below water level. The depth of water on the site was from one to six feet and the material over the rock was lake bottom silt with gravel seams making the dredging of slips alongside the dock quite practical. The railway connection could be made without interference with existing railway facilities and traffic and also without disturbing any built-up area in the city as practically all street crossings could be made overhead and very few buildings were present on the right-of-way. Navigation to the dock site through the south entrance of the harbour breakwater is excellent and ore carriers will be able to berth at the dock without assistance from tugs. Any probable future expansion can be made on this site to both the dock and the railway approach without interfering with ore shipments on the completed dock.

Structural Details

The Port Arthur iron ore loading dock now under construction is similar to latest practice on the Great Lakes in the American iron ports. It is being constructed almost entirely of reinforced concrete containing 100 pockets, 50 on each side, with a total working capacity of 30,000 long tons of iron ore. Figures 2 and 3 illustrate the general features of the pocket dock section.

The pocket structure has a length of 600 ft. and an over-all width of 64 ft. 8 in. and a height of 82 ft. 6 in. from mean low water to the base of rail on the dock. The mooring dock extends 200 ft. inshore and 54 ft. outshore from the pocket section making an over-all mooring length of dock of 854 ft. The pockets are 12 ft. centres to register with the usual 24 ft. spacing of hatches on the ore carriers and the special ore cars are 24 ft. centres coupled to register at every other pocket for unloading. Each pocket will contain 300 long tons of iron ore being filled by five or six carloads. Figure 4 shows the designed section of one pocket and the sequence of filling same from the cars overhead. A working model of the pocket, ore car, chute, and cross-section of the ore carrier was built to a scale of ½ in. to the foot and ½ in. crushed stone was used for experiments in filling the pocket and unloading same through the hatches of the ore carrier. This was done to check experimentally the design work in determining over-all dimensions of the dock required and to establish the proper pocket dimensions for loading under all conditions. The maximum capacity of the ore cars being delivered is 1,000 cu. ft. or 65.5 short tons. If heavy ore is shipped the contents of the car will be about 825 cu.



CONDENSED PLANS AND SIDE ELEVATION

Fig. 2—Typical plans and elevations of ore dock.

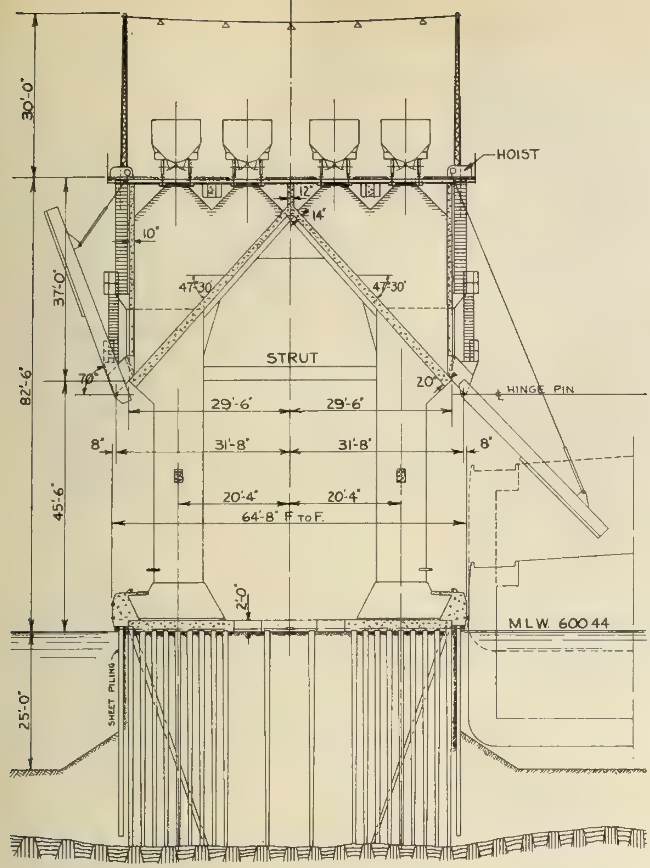


Fig. 3—Typical cross-section of ore dock.

ft. In the design, illustration cars of 950 cu. ft. capacity were used which is near the maximum condition. This experimental work done on the scale model was checked with results of surveys made by American railroads in actual pockets on their docks and the experiments agreed fairly well with the full scale survey. The model was useful also in determining the proper position of the hinge pins on the ore chutes above lake level to load the full cross-section of the ore carrier without too much trimming operation.

The pocket structure is 59 ft. wide face to face of side walls and is divided into 50 pairs of bins by transverse walls 12 ft. centres and 16 in. thick making the inside width of bins 10 ft. 8 in. lengthwise of the dock. The bins have a depth of 37 ft. at the outside and 5½ ft. at the centreline of dock where adjacent bins are separated by a 12 in. wall. The bottom has a slope of 47½ deg. from the horizontal and the slab thickness increases from 14 in. at the top to 20 in. at the bottom. This variation provides for increase in load from the top to the bottom, and a maximum allowance of two inches extra thickness at the top tapering to zero at the bottom is made to provide for wear on the concrete bottom slab. Most of this wear is beneath the inside track when the first carload emptied strikes this slab. The balance of the carloads fall on ore but do not affect the slab. The movement of the ore to the boats does not create as much wear as the unloading of this first car. Intersections of all walls and slabs are filleted to facilitate the flow of ore and provide for corner stresses. The cross walls are stayed at the top midway between the railway tracks by a concrete beam which acts both as a tie and a strut. The whole bin structure is monolithic for lengths of 120 ft. between the expansion joints.

The railway approach is single track and switches to four tracks at the inshore end of the pocket section, each track on the dock having room for twenty-five car loads of ore. The rails of the four tracks on the dock are carried on I-beams set on bearing plates on the transverse walls. The space between the rails is entirely free of bracing to permit the passage of ore from the cars to the pockets, all bracing being done between the tracks and on the outside machinery deck. The deck structure is made of similar I-beams and channels spanning crosswise to support the concrete dock slabs and hoist machinery.

The live and dead loads of the bin structures are supported on reinforced concrete bents in the planes of the transverse walls, these bents consisting of two columns 9 ft. wide by 2 ft. 9 in. thick, spaced 40 ft. 8 in. on centres so that each column of the pair is located substantially under the centroid of its respective bin load. The columns are braced across at the bottom of the pockets and longitudinally near their middle height by reinforced concrete struts. In the middle of each section and at both ends of the dock a 16 in. thick wall between columns provides tower bays for longitudinal bracing.

At the base of columns a pedestal footing is provided, combined with the mooring dock walls, to distribute the loads over the reinforced concrete mattress. Because of the wide spacing of the columns, the mattress is divided into two longitudinal sections tied together at intervals with cross slabs. These mattresses and slabs are all 2 ft. thick, poured directly on the filled site which was graded 2 in. below the pile cut off at low water level.

The pocket section is divided into five sections of 120 ft. each and the four expansion joints of these sections are located at the face of transverse walls. The slabs and walls of the expansion pocket are formed into grooves made of steel plates and angles anchored in the face of the adjacent transverse wall. All metal surfaces in these expansion joints are coated with warm tallow when erected in the forms. An expansion of 1 in. is allowed. A complete separation between sections is made at each joint right through to the mattress level and a 1 in. filler of paraplastic was used at all joints not protected by steel plates, to prevent ore dust from getting into the expansion space.

Foundations

The foundation consists of timber piling driven to refusal on solid rock and cut off at mean low water level, the area being filled with sand dredged from alongside the dock to the mattress grade. Along each side and at the ends the entire dock area is enclosed with a 10 in. Wakefield timber sheet pile wall. These sheet piles are 34 ft. in length, cut off one foot above mean low water and bolted at the top with two timber wales and a 12 in. steel channel. Tie rods 1½ in. diameter at 6 ft. centres are placed across the full width of the dock to tie back the revetment. The whole top of the revetment and tierods are encased in the concrete mattress and dock walls. Batter piles are driven at 6 ft. centres along each side to give additional stability to the foundation section. After completion of this revetment dredging operations were carried out on both sides.

Mechanical Equipment

The equipment on the dock consists of a pocket gate, ore chute, and electric hoist for operation of the gate and chute on each ore pocket. The ore is discharged from the pockets through openings 7 ft. wide and 5 ft. 4 in. high in a vertical direction, or 3 ft. high normal to the bottom slab. This opening is provided in a steel gate frame set in place in the forms when the concrete is

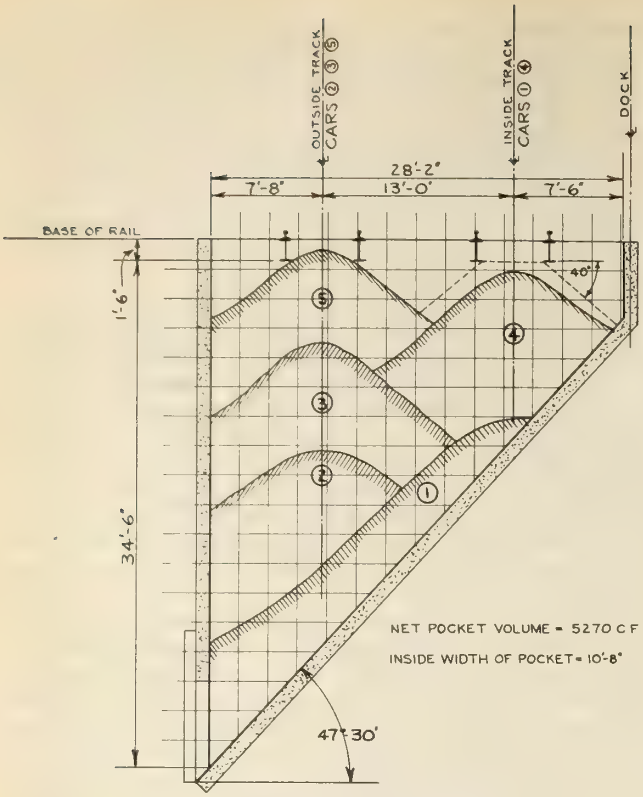


Fig. 4—Ore pocket filling section.

poured, and on its lower portion, on the outside, a steel plate frame is connected to enclose the gate mechanism and for attaching the hinge pins of the ore chute. The gate is 7 ft. wide and 4 ft. high, made of steel plates, channels and angles, operating vertically and guided by means of two pins attached to the top of the gate and running in slots at the side frames. The bottom of the gate is held in the closed position with a forged U-shaped bar resting on two dogs on the sides of the frame. For opening the gate these dogs are released by a lever mechanism at the top deck, allowing the bottom of the gate to swing outward and releasing the ore. The gate is then raised by a small drum on the hoist machine until it is clear of the ore stream. To close the gate it is raised to the top position by the hoist and the dogs are reset by the lever meshanism at the top deck. The gate is then lowered by its own weight and the U-shaped bar engaged by the dogs forces the gate back into the closed position. If any one is still running, the down movement of the ore at the opening tends to assist the closing of the gate.

Below the gate an ore chute 36 ft. long, 7 ft. wide at the top and 4 ft. 10 in. wide at the bottom, is attached to the gate frames by means of two hinge pins. This chute is made of steel plate stiffened by angles and channels, the plates being curved at the side corners and carefully made flat to prevent excessive wear near supports.

On the lower side of the chute near the outer end, two steel rails are attached to prevent damage to the chute should it strike the hatch combing of a boat or other obstruction.

The chute is lifted and lowered by means of a steel bail attached to the sides of the chute and connected to the hoist drum by a 3/8 in. thick by 5½ in. wide steel ribbon cable. This cable is provided with special sockets at each end and winds on the drum in line, the increasing diameter of the wound cable compensating for the change in load as the chute is elevated to the housed position clear of moving boats. The chute is lowered by gravity controlled by a brake drum on the hoist.

The hoist machine is mounted on a machinery deck on the operating floor of the dock. There is a hoist machine for each pocket and ten machines are driven from one lineshaft driven by a 25 hp. motor through a gear speed reduction. The hoist machine has two drums, one for the chute and the other for the gate. Each drum has a separate friction clutch to pick up the load and a separate brake band for lowering the load by gravity. In operation, the lineshaft runs all the time loading is going on in the ten pockets involved and the operator handles each machine individually with simple foot pedal and lever controls. Any number of chutes or gates can be operated at one time, depending on the number of operators required to handle the loading. Usually, two men can do this work for each boat and only one operator will be working at a time in each section of ten pockets.

Services

Complete access by means of stairways, ladders and walkways, is obtained to the gates and chutes from the top operating deck. Poke holes are provided in the top deck to permit operators to poke down sticky ore which does not run freely from the pockets. Wooden poles up to 36 ft. in length, provided with metal chisel points, are used for this work. It is expected that Steep Rock ore will be free running and give little trouble at the dock during loading operations.

Lighting for night operation is provided over the whole dock and portion of the railway bridge where switching takes place. On the top deck, this is done by installing strings of five lights between steel poles at intervals, lighting up the whole deck area. There are lights also inside the pockets and along the walkways. On the railway bridge, lights are located on wooden poles at the sides of the trestle. Flood lighting of the track area is not used to avoid glare interfering with the train crew switching operation, and all lights in this area are directed downward. Navigation lights and dock lights at intervals are provided to light up the whole length of the mooring dock on each side.

At the outer end of the pocket section, a three bent timber trestle, four tracks wide, is provided to allow sufficient track room for full use of the end pockets. The outer end of the pocket section is designed to permit construction of additional pocket sections in the future and this trestle section would be rebuilt further out. Stairways from the ground level for access to the operating deck are located at each end of the pocket section in the timber trestle. At the top of the inshore stairs, office accommodation and a welfare room for workmen is provided at the side of the approach trestle.

Electrical power for the operation of the dock will be delivered to an outdoor substation at 2,300 volts, located on the shore at the inner end of the north slip. The substation will transform this power to 550 volts for distribution to the ten motors operating the hoist machines and to lighting transformers located throughout the dock to suit the lighting distribution at 110/220 volts.

Railway Connection

The railway approach to the dock is approximately 2½ miles in length and has a single track dividing to four tracks at the dock. The approach track leaves the C.N.R. main line immediately north of the McIntyre River crossing and follows ground levels for a mile to the dock yard tracks located alongside the approach track and connected to it at each end. This yard is about one-half mile in length and is also level grade. At the northerly end of the yard, about one mile from the dock, the approach spur rises on a maximum grade of 1.75 per cent. The first section to Memorial avenue is on fill. Memorial avenue, the main automobile highway, has an overhead crossing of steel plate girder deck span with a minimum clearance above the highway of 14 ft. Between Memorial avenue and the Fort William road the approach is carried on standard timber trestle of framed bents resting on cedar piling. The next 550 ft. is carried on steel viaduct of towers and plate girder deck spans. This section crosses the street railway track, the Fort William highway, the main lines of the C.P.R. and C.N.R. and the yard tracks of the C.N.R. The balance of the approach, 2,500 ft. in length, is carried on standard timber trestle, reaching a height of 80 ft. above the ground. The last 1,000 ft. of the approach is on a level grade to permit switching of ore cars on to the pocket section without the excessive use of air brakes.

Fig. 5—View of construction progress at end of November, 1944.

The ore trains from Atikokan will be received at the main yard of the C.N.R. at Neebing, west of Fort William, and the ore cars will be classified there in a hump yard, in the proper order according to grade in which they will be placed on the dock. The usual switch engine transfer will be made from the Neebing yard to the ore dock yard alongside the approach. At this point, a Diesel-electric switch engine will take the loaded cars up the grade to the dock for unloading and return the empty cars from the dock to the yard. This Diesel-electric switch engine will be able to handle up to a maximum of 25 loaded cars at a time on the approach grade. The regular steam switch engine will return the empty cars to the Neebing yard where empty car trains will be made up for return to Atikokan. The use of a Diesel-electric switch engine on the dock approach was decided upon to lessen the fire hazard to the timber trestle section and also on account of the high tractive effort of this type of switch engine for short periods of operation compared to the steam switch engines in general use at the Lakehead.

Construction

Construction of the ore dock was started in April 1944, with the foundation contractor moving on the site to drive the foundation piling and revetment required and also to grade the dock site in preparation for pouring the concrete mattress and footings. Piling and timber for this work was ordered in advance of the start of construction and this foundation work was completed in about four months time. 4,700 timber foundation piles were driven and about 2,000 lin. ft. of timber revetment placed in this contract. One scow pile driver and one swing pile driver were used, both with drop hammer equipment. All piling was jetted and driven to refusal.

The superstructure contractor moved on the site about the 1st of June 1944, and actual pouring of mattress concrete was started on August 4th. There is about 19,000 cu. yd. of concrete to be placed on the whole work and, at the date of the progress photograph shown in Fig. 5, about 9,000 cu. yd. had been placed up to the top of the columns. The concrete forms, made of lumber, were made up in the yard as much as possible, hauled to the site and erected with caterpillar cranes. As there is a good deal of repetition of sections on this work, the same forms are being used two or three times. Concrete aggregates are produced from Lake Superior sand and gravel dredged from the lake bottom pits and brought to the site on scows. The contractor has set up a screening plant for separation of the gravel into fine and coarse aggregates. This separated material and sand is weighed in batches below bins and taken to the mixing plant in trucks where cement and water are added. A Rex Paver concrete mixer—one cubic yard capacity—is used for the mixing of concrete and is located on a ramp to permit discharge of the mixed concrete to a pump machine. All concrete is delivered to the work by a Rex Pumpcrete machine through an 8-in. pipe line at a rate of 25 to 33 cu. yd. per hour.

Because of the late start in the season making it necessary to carry out concrete operations in winter weather, full provision has been made to heat all materials for the concrete and also to house the mixing plant and the upper portion of the dock structure. This will permit full protection for the workmen during the forming period, and heating of the concrete after it is poured. Concrete aggregate stock piles have been established during the navigation season from the screened gravel and sand to permit construction of the work during the winter months until further aggregate can be delivered by scows in the spring. It is intended to carry out sufficient concrete work this winter to permit completion of at least one-half of the pocket section of the dock and all of the approach trackage, ready for operation at the opening of navigation next April. The balance of the work will be done in the spring for completion of the whole project during the early summer of 1945.

Dredging of two slips, one on each side of the dock, was completed in November. These slips are dredged to 25 ft. depth below mean low water for a width of 150 ft. from the dock face. On the south side, the new slip is adjacent to an existing slip at the Reliance elevator, making a basin 275 ft. in width between the faces of the elevator dock and the ore dock. The dredging was carried out mainly by the suction dredge *Primrose*, having a 23-in. suction cutter and a 20-in. discharge pipe line. Material from this dredging was used to fill the low area near the C.N.R. main yard about 4,000 ft. distant from the dock. The dipper dredge *Excelsior* completed portions of the work where the material was too hard for the suction dredge or where obstructions were present. This material was dumped in the open lake with scows. The total dredging done was about 300,000 cu. yd.

Contracts and Cost

The contract work for the ore dock and approach is being done by Tomlinson Brothers Ltd., of Toronto and Port Arthur, in three sections, covering approach filling, the trestle and viaduct, and the ore dock section. The foundations for the ore dock were carried out by the Thunder Bay Harbour Improvements Ltd., of Port Arthur, in advance of the superstructure contract. The dredging contract, arranged by the Dominion Department of Public Works, was done by the Canadian Dredge & Dock Company. The design and supervision of the entire project is being done by the Canadian National Railways Engineering Department, with the exception of the ore dock section which is being handled by C. D. Howe Company Limited, of Port Arthur, on a consulting basis with the railway company.

The cost of the project is expected to be about $2,500,000. This includes the dock and approach at Port Arthur and the spur from Atikokan to the mine. Other expenditures are being made by the railway company for ore cars and such main line track improvements as may be required.

LIGHTHOUSES AND DEPTH CHARGES

The "man in the street" knows what a vital part in winning this war has been the destruction of the enemy's submarines, but possibly he is not aware of the contribution made by the Federal Department of Transport in this regard. Admittedly, the connection between the two is not quite obvious, and yet is there not a subtle association between Aids to Navigation and the destruction of such a deadly menace?

People who regard the various departments of our government merely as so many agencies for the expenditures of public moneys doubtless will be interested to hear of a Dominion Government department which has successfully entered the manufacture of munitions on a large scale, while still carrying on its regular functions and technical developments.

With the Honourable J. E. Michaud as Minister, and Commander C. P. Edwards, M.E.I.C., as Deputy Minister, Marine Services operate under the directorate of J. G. Macphail, M.E.I.C. A division of Marine Services is known as The Aids to Navigation Branch, with H. V. Anderson, M.E.I.C., as Chief, and it is through his initiative and enterprise that a unique development in engineering production has taken place in an entirely departmental organization.

When a German submarine is sent to the bottom by depth charges discharged from Canadian or British fighting ships, and even mercantile marine of all Allied nations other than the United States of America, the workers at the Dominion Lighthouse Depot, situated on the peaceful banks of our St. Lawrence river at Prescott, Ontario, are entitled to take satisfaction.

Since 1941 they have been making a substantial contribution to the defeat of the enemy under the sea. This is the only factory in the British Empire, outside of the British Isles, engaged in such work, and in fact there is no factory, even in the United Kingdom, with an output of these vital pieces comparable with that of the Federal workshops at Prescott.

The transition from the peaceful occupation of manufacturing lighthouse apparatus, such as revolving mechanisms for optics, reflectors, burners, fog horns, buoys and buoy lighting equipment, to the manufacture in mass production of these important naval stores, has proved to be a very heavy task. This was made especially involved as it was necessary to do so without in any way impairing the Canadian Marine Service of aids to navigation, so well carried on by the Department of Transport. Lighthouses, beacons and buoys continue to help the mariner wherever they can be operated without aid to the enemy.


H. V. Anderson, M.E.I.C.

In the summer of 1940, the Dominion Lighthouse Depot shops were enlisted to manufacture bombing targets for the R.C.A.F. Later, snow-drags for runways were supplied also to the R.C.A.F.

Mr. Anderson, Chief of Aids to Navigation, through his enquiries, having as an objective the increased usefulness of facilities available, early in 1941 learned that the Department of Munitions and Supply were having difficulty in placing a Canadian contract for 10,000 pistols and primer mechanisms, complete with casings, for the weapon known as a "depth charge". Negotiations were opened with the Bomb Division, Department of Munitions and Supply, from which there developed a contract requiring the Department of Transport to deliver these vital parts of the depth charge at the rate of 2,000 per month.

Explosion of depth charge at sea.

buildings almost fifty years old, and has been specially commented upon by a New York company's report on the standard of efficiency obtaining. All prevailing wage scales and salaries were approved by the War Labour Board, and the government has extended to the personnel the privileges of six days' leave with pay per annum under certain conditions of service.

In conjunction with Prescott's part in the U-boat war, the Dominion Lighthouse Depot has developed a large wood-working section producing several kinds of heavy transportation cases for torpedoes and other munitions. High officials of the British Admiralty Technical Mission have, on several occasions, expressed their appreciation of the quantity of work performed, and the very high standard of workmanship maintained.

Over 2,500 tons of non-ferrous metals have been used in production; more than 120 tons being cast in the depot's own brass foundry. Included in the metal used has been substantially more than 175 miles of extruded brass bar, 450 tons of stainless steel, and the amount of lumber consumed is well in excess of 600 miles foot board measure.

Pistols and primers are far from being simple devices. They are operated on a hydrostatic-time principle and must have considerable selective operating depth to insure effectiveness in varying depths of water where the submarine may lurk on its deadly mission. When a pattern of depth charges is being laid down around a submerged U-boat, in many cases the charges are thus arranged to fire at varying depths, and so find their mark. In this connection a unique development in the process of manufacture has been introduced, and this method was greatly praised by the Admiralty officials following this project.

With no previous experience of such work, more than 600 men and women have made the Dominion Lighthouse Depot at Prescott a bee hive of industry, much admired by industrialists who have visited the plant.

Workers recruited from country places in the vicinity of Prescott have been trained, and practically no physically fit men of military age are now employed. It was found necessary to establish a plant school to introduce these unskilled workers to the mystery of micrometers and the intricacies of precision lathes. This was accomplished through the assistance of the Provincial Department of Labour which met the expense of a qualified teacher. At the commencement of activities to manufacture munitions of war, there were only about 35 workers at the Prescott depot; now there are approximately 650, of whom 150 are women and girls, operating two ten-hour shifts, which at peak loads have been working seven days a week.

A very high standard of efficiency is maintained throughout the whole organization, and all workers seem to be imbued with the importance of the work being performed. This efficiency is reflected in the exceptionally low costs of handling materials, particularly in

Without publishing the actual output of depth-charge pistols and primers, it can be said that some months ago the total had exceeded 150,000, with a monthly output reaching as high as 9,000, and in monetary value, the total output is well in excess of $6,000,000. It should be added that practically all contracts for war work at the Dominion Lighthouse Depot have been secured by tender, in open competition, and at these prices very substantial surpluses are being built up, to be refunded at the conclusion of all contracts.

Healthy working conditions in the shops have helped to promote production. A cafeteria is operated under the auspices of the plant by an elected committee. Profits accruing from this cafeteria enterprise revert to the recreational association who carry on activities in swimming, softball and tennis during the summer, and skating, curling and skiing in the winter. A dormitory has also been established in conjunction with the Merchant Seamen Marine School, this dormitory housing from forty to fifty men. There is always a waiting list for same.

Altogether the war work of the Dominion Lighthouse Depot at Prescott is highly creditable to the government, whose policy of making the best possible use of every workshop, every machine and every available worker to contribute to Canada's part in winning the war is being well carried out by the Department, under the responsible Minister of Transport, the Honourable Joseph Michaud.

FIFTY-NINTH ANNUAL GENERAL

WINNIPEG — ROYAL

WEDNESDAY, THURSDAY and FRIDAY

F. V. SEIBERT
General Chairman

T. H. KIRBY
Vice-Chairman

WEDNESDAY, FEBRUARY 7th

9.00 a.m.—Registration.

9.30 a.m.—Annual General Business Meeting of the Institute.

11.15 a.m.—**Steep Rock Iron Mines—Discovery and Development,** by Watkin Samuel, Chief Engineer, Steep Rock Iron Mines, Toronto.

12.30 p.m.—Luncheon—Speaker: John S. Galbraith, M.E.I.C., Head of the Community Planning Division, National Housing Administration, Ottawa—**The Engineer and the Community.**

2.15 p.m.—**Diversion of the Seine River at Steep Rock,** by A. W. F. McQueen, M.E.I.C., Hydraulic Engineer, and C. N. Simpson, Jr.E.I.C., Assistant Engineer, H. G. Acres & Co., Consulting Engineers, Niagara Falls, Ont.

Diamond Drills and Well Drills on the Raft Lake Canals at Steep Rock, by C. H. Hopper, M.E.I.C., Consulting Mining Engineer, Boyles Bros. Drilling Co., Limited, Vancouver, B.C.

Iron Ore Loading Dock at Port Arthur, by J. Murray Fleming, M.E.I.C., President, C. D. Howe Co., Limited, Port Arthur, Ont.

5.30 p.m.—Special Convocation of the University of Manitoba to confer honorary degree upon de Gaspé Beaubien, president of the Institute.

6.30 p.m.—Dinner tendered by the City of Winnipeg to the delegates at the meeting.

8.30 p.m.—**Post-war Plans for Rural Electrification in Alberta,** by E. G. Kelly, Superintendent of Construction, Canadian Utilities Limited, Calgary, Alberta.

Farm Electrification—A New Science, by J. W. Tomlinson, Assistant General Superintendent, Manitoba Power Commission, Winnipeg, Man.

Discussion by representatives of Canadian power companies and Government organizations.

THURSDAY, FEBRUARY 8th

9.30 a.m.—**Soil Mechanics as Applied to P.F.R.A. Problems with Special Reference to the Proposed St. Mary Dam,** by R. Peterson, Jr. E.I.C., Soil Mechanics Engineer, P.F.R.A., Department of Agriculture of Canada, Saskatoon, Sask.

W. P. BRERETON
Chairman of the Reception Committee

J. T. DYMENT
Chairman of Transportation and Excursion Committee

H. L. BRIGGS
Chairman of the Finance Committee

AND PROFESSIONAL MEETING

ALEXANDRA HOTEL

FEBRUARY 7th, 8th and 9th, 1945

Application of Soil Mechanics to the Design and Maintenance of Prairie Highways, by G. B. Williams, Department of Public Works of Manitoba, Winnipeg.

12.30 p.m.—Luncheon—Speaker: George Spence, Director of Rehabilitation, Department of Agriculture of Canada, Regina, Sask. — **Post-war Projects for the Prairies.**

2.15 p.m.—**Principles Involved in a Modern Concept of Airline Operations,** by J. T. Bain, Superintendent of Engineering and Maintenance, Trans-Canada Air Lines, Winnipeg.

The Engineering Development of an Airline Aircraft, by J. T. Dyment, M.E.I.C., Engineering Superintendent, Trans-Canada Air Lines, Winnipeg.

The Future of Radio Communications in Commercial Air Transportation, by S. S. Stevens, Superintendent of Communications and Electronic Development, Trans-Canada Air Lines, Winnipeg.

New Developments in the Field of Materials and Processes, by P. E. Lamoureux, Materials and Processes Engineer, Trans-Canada Air Lines, Winnipeg.

7.30 p.m.—Annual Banquet—Speaker: Honourable Stuart S. Garson, K.C.

10.30 p.m.—Dance.

FRIDAY, FEBRUARY 9th

9.30 a.m.—Visit to Stevenson Airport and Shops of Trans-Canada Airlines.

2.30 p.m.—Visit to University of Manitoba, Fort Garry Campus, including tour of Engineering Building. Tea will be served by the University of Manitoba Engineering Society.

LADIES' PROGRAMME

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

Through the courtesy of the Engineers' Wives Association of Winnipeg, a ladies' tea will be held from 3.00 to 4.30 p.m., Wednesday, February 7th, at the University Women's Club (Complimentary to visiting ladies).

The Ladies' Committee of the Annual Meeting is arranging a special feature for Thursday, February 8th, at 2.30 p.m., in the form of visits to interesting places, which the ladies have called "Wanderings".

D. M. STEPHENS
Chairman of the Papers Committee

R. A. SARA
Chairman of the Publicity Committee

C. V. ANTENBRING
Chairman of the Registration and Information Committee

A. E. MACDONALD
Chairman of Ladies' Committee

W. D. HURST
Chairman, Hotel Arrangements, Luncheons, Banquet and Dance Committee

From Month to Month

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

GREETINGS TO THE INSTITUTE

Each year a great many Christmas and New Year's greetings come to the Institute. One of the pleasantest experiences of the year for the general secretary is to receive these good wishes on behalf of the Institute. The messages come from members, sister societies, officials of government, institutions of learning and business organizations in many parts of the world.

The sum of this goodwill cannot be added up to a numerical figure but it is none the less an impressive manifestation of the place of the Institute in Canadian affairs. It is an indication of the important part the Institute has played in the past and is an encouragement to expand its usefulness in the future.

It is not reasonably possible to acknowledge all messages, or to return individually the good wishes, but to all those who have been kind enough to send greetings, may this be taken as an acknowledgment and an expression of appreciation.

PROFESSIONAL WORKERS AND COLLECTIVE BARGAINING

The group of societies which has become known as the "Committee of Fourteen" met again in Ottawa on December 20th to re-survey the situation in the light of an invitation to appear before the National Wartime Labour Relations Board on January 9th. A similar invitation had been sent to a large number of organizations and individuals, including professional societies and trade unions.

Some time ago, the sub-committee appointed for the purpose presented a draft of the proposed new order-in-council to the Minister of Labour. The purpose of this order-in-council is to make possible to the professional worker a basis for collective bargaining whereby he would be in control of his own negotiations. Subsequently, the Minister informed the sub-committee that he had referred the proposal to the Wartime Labour Relations Board for a report. This explains the invitation referred to in the previous paragraph.

The sub-committee has prepared a brief for presentation to the Board, which was approved by the major group at the December meeting. In order that members of the Institute may be kept fully informed, the brief is reproduced in full on page 49.

By way of a news report to our members, in Ontario there has been established through the assistance of the Association of Professional Engineers, a group referred to as the Federation of Employee-Professional Engineers and Assistants for purposes of collective bargaining. The *Journal's* information is to the effect that only engineers who are members of the provincial association are eligible for membership in the Federation. It appears as possible that this restriction will cause other groups of professional workers to set up their own bargaining agencies thereby further complicating and confusing an already complicated and confused situation. Nevertheless, the Ontario Association is to be congratulated on its enterprise, and everyone will hope that wide success will attend its efforts.

In Quebec, under the leadership of the Corporation of Professional Engineers, progress has been made towards setting up a group similar to that in Ontario, but with this distinctive difference. It is proposed that the Quebec group will not be restricted to one society but that it shall be a co-operative organization representing all qualified organizations that desire to be included. At the time of writing, this organization has not been completed, but it is well advanced.

VOLUNTARY ASSESSMENT

Each Corporate Member and Junior of the Institute will have received with his annual account for fees a special message from the Finance Committee relative to a voluntary assessment for purposes of rehabilitation of members in the services. There is little to be added to the Committee's message, but it is hoped that the proposal will be well received.

This decision was not made hastily. The subject has been before the Committee and Council for over a year, and the problem has been examined from every angle. The only alternative to the assessment seemed to be an increase in fees. Because of necessary by-law changes which would take from one to two years to become effective, the assessment method was chosen instead.

The need of a special service, co-ordinated with other services, to members returning to civil life is already present. Every day, Headquarters receives a number of enquiries in person or by mail from those who want assistance. The present staff is not adequate to render the detailed service that will be necessary, and the Institute must not be found wanting. It is believed that all members at home will realize the Institute's responsibilities in these matters.

INCREASE IN MEMBERSHIP

It is always interesting at the year's end to check up on the total of membership. For many years now there has been a steady increase, and the end of 1944 sees the Institute well on the way to reaching seven thousand members.

The largest society in the United States now has about twenty thousand members. Sometimes we get a better perspective of our own affairs when we look at them in comparison with others.

Comparing the above figure on a population basis with the membership of the large American societies, we find the Institute's membership much greater than that of any other similar organization. A society in the United States with the same percentage of the population would have a membership of about eighty thousand.

In the last two or three years there has been an encouraging upswing in the number of applications for membership received from students. This reached a new level in 1944 when approximately five hundred students were admitted. This is specially gratifying in view of the disturbed conditions at the universities brought about by the war.

This trend is an indication that there is work to be done by the Institute for the student. Those branches that are situated in a university city have special opportunities to aid in the development of the future engineers. The increase in numbers of Junior Sections is a sign that the branches are aware of these oportunities.

For several years, the Ecole Polytechnique in Montreal has given the Institute outstanding support. In 1944, 249 students out of a total enrolment of 330 were members. In the last three months of the year, 150 applications were received through the efforts of Léo Scharry and J. P. Laviolette, the Ecole representatives in the Junior Section of the Montreal Branch.

There has also been a considerable increase in activity at the Universities of British Columbia, New Brunswick, Mount Allison and Queen's.

Increased membership brings increased responsibilities to branch executives and to headquarters. At headquarters this development is producing a most noticeable effect in a greatly increased volume of work. If this trend continues, at the present rate, the time is not far distant when substantial changes will be necessary, both in staff and quarters. Again referring to the admirable sister societies in the United States, on a comparable basis, the Institute staff should be more than twice as large as it is now.

These are matters of concern to council and to the membership, which will require consideration and study shortly—if not immediately.

THE REMUNERATION OF THE ENGINEER

Elsewhere in this number of the *Journal* are letters from members complaining of the remuneration received by the engineer. It is interesting to see this activity in the thinking of the young engineer, and the *Journal* is pleased to publish such letters (even though a trifle long). Each contributor has left many holes in his argument, and there is the temptation to shoot through them, but the letters are sincere and must be taken as such.

Usually when an engineer speaks of the remuneration of the profession he is speaking of himself. This is only natural. If he is inadequately paid he thinks the whole profession is, and if he is well paid he is likely to forget that many others are not. On the whole, however, it is probable that the profession of engineering is paid as well as any other profession. Some time ago, a survey was made in the United States which showed that engineering was the best paid of all professions. This is hard to believe but it is submitted as evidence which should be kept in mind when speaking of such things.

One correspondent states that prospective engineers should be told that all they will get out of engineering is an income no better than that of a small storekeeper, etc. He goes on to say that "a few lucky ones through influence or heritage" are able to do better. That is an unfortunate statement not very complimentary to thousands of engineers. How will this correspondent feel if some day he finds himself with a better income than "a small storekeeper"?

Again the letter writer may be considered by many to over-exaggerate in his reference to the employment methods of those engaging engineers. Many will doubt that the job goes to the lowest bidder and not "the one best fitted for it."

Criticism of these letters is not intended as a contradiction of the case they make for better salaries. There is much room for improvement, but there may be more effective means of bringing it to pass than by the specific proposals contained in the letters.

It is doubtful if there is any single factor that does more injury to engineers' incomes and professional status than the pittances usually offered by governments—municipal, provincial and federal. Perhaps in this field the job does go to "the lowest bidder," not to "the one best fitted for it." The salary scale is so low that no one would take the place if he could get employment elsewhere. As long as such outstanding employers as governments persist in paying wages that starve a man both physically and mentally, there can be no hope for an upsurge in professional recognition for the engineers across Canada.

Perhaps as the correspondents state, engineering organizations can do something to help. For years the Institute has been battering the doors of government that are shut on progress in this direction, but so far no impression seems to have been made. The mountain of indifference is still unmoved.

One tragic feature that is uppermost in all the recent discussions in collective bargaining is that government employees are excluded from such legislation. If ever any group of engineers needed a union it is those in the service of cities, provinces and the Dominion.

MINING INSTITUTE ACHIEVES UNIQUE SUCCESS

The usefulness of a national technical society in affairs of national importance was clearly demonstrated by the Canadian Institute of Mining and Metallurgy at its recent Annual Western Meeting in Vancouver, when its president invited to the meeting the Ministers of Mines or the Minister of Natural Resources of each of the provinces in which minerals are mined. Out of eight such ministers, six were able to be present.

It was arranged that the ministers would meet privately, prepare their own agenda, and conduct their own discussions. Eventually they released the following statement:

> "For the purpose of assisting in every way possible the development and production of the minerals of Canada in the best interests of the nation, and of establishing a basis of agreement on the problems affecting the mining industry, six of the eight Ministers of Mines of Canada took advantage of the western meeting of the Canadian Institute of Mining and Metallurgy to hold several conferences.
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> "The first of these was convened by A. A. MacKay, president of the Institute, the second by Hon. E. C. Carson, Minister of Mines of British Columbia, and subsequent conferences followed. The ministers attending were: Hon. E. C. Carson, British Columbia; Hon. N. E. Tanner, Alberta; Hon. J. S. McDiarmid, Manitoba; Hon. Leslie M. Frost, Ontario; Hon. Jonathan Robinson, Quebec; and Hon. L. D. Currie, Nova Scotia. The Ministers of Mines of Saskatchewan and New Brunswick were unavoidably absent.
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> "An agenda was tentatively drawn, which will receive careful study and will be the subject of further joint conferences between now and the Annual Meeting of the Institute at Quebec next April, when it is expected that a joint agreement will be reached by all the ministers.
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> "The ministers attending were highly pleased with the meetings and expressed the feeling that much could be accomplished in other fields by ministers of all departments of the provincial and federal governments getting together, so that a common understanding could be reached on all the problems and matters that concern the nation, and so that the cause of Canadian unity in all its aspects will be advanced.
>
> "Some of the matters discussed were measures to achieve conformity, where desirable, in mining legislation and security laws, wider cooperation of all de-

partments of mines across Canada, problems of taxation, conservation and development of the industry from a national as well as from a provincial viewpoint. The ministers expressed keen concern over the vital question of Canadian unity and Canada's future contribution to civilization, and felt that the initial steps taken at their meetings would help to promote that desirable end".

An extension of the work done on the above subjects will be arranged for by the establishing of provincial committees to study them. These committees will be coordinated by a central committee under the chairmanship of the Minister of Mines of Ontario. The work of the provincial committees will be the basis of further joint conferences which may culminate in another conference at the time of the annual meeting of the Mining Institute in Quebec next April.

The conception of the idea and its successful achievement are a tribute to the officers of the Mining Institute. It is doubtful if such a conference has ever been arranged before by any organization other than a government agency.

Is there not in this the seed of an idea applicable to other fields as well? As the meeting at Vancouver suggested, it is possible "that much could be accomplished in other fields by ministers of all departments of the provincial and federal governments getting together." The good example of the Mining Institute might well be followed by the Engineering Institute with other ministries. Such action would be one means of complimenting the Mining Institute on its progressiveness and its interest in the national welfare.

AUTUMN REVERIE

It will be autumn home,
Clear, cool nights and lazy days.
The smell of leaves burning,
A big, soft moon through yellow haze.
No shifting sands and heat.
It will be autumn home
And from the hill and wood
The trees will blaze defiantly
Bright as a chieftain's hood
Rich wines and native gold.
It will be autumn home.
The waning sun soon dies.
From a thicket on a country road
A flash of colour where the pheasant's rise
Sets the hunter's heart aflame.
It will be autumn home.
Along an old, familiar street
Generous maples spread their gold
So soon to vanish under careless feet
And turn to dust.
It will be autumn home.
But here, the seasons go
Not marked by colours bold
For one can scarcely know
When spring is here,
Or summer slips away.

John Simmons Watt, Jr.E.I.C.

Bahrein Island, Persian Gulf, 1944.

CHANGE IN STUDENT FEES

Beginning in January, 1945, Student members will all receive *The Engineering Journal*, the same as other members. This is in accordance with the change in by-laws proposed in 1943 and approved early in 1944. Up to now, Students have had the option of taking or not taking the *Journal*. Council has felt that the Institute could render a greater service to this group if all received the monthly publication.

There is a change in fees also whereby the annual contribution becomes $3.00, less the usual one dollar discount for prompt payment. This should work no hardship on anyone, but should go a long way towards binding the future members of the profession to the Institute and to each other.

A proposal to inaugurate a special Student and Junior section in the *Journal* was approved some time ago by the Publication Committee, and it is hoped this innovation may appear shortly. There is considerable organization work to be done to secure a steady and adequate supply of suitable material, and it is not planned to start the section until these details have all been arranged satisfactorily.

LECTURES IN MATHEMATICS AND SOIL MECHANICS

Junior Section of Montreal Branch Sponsors Series

It is some time since a branch has inaugurated a series of lectures for the benefit of members, and it is even longer since such action has been taken by a junior section—all of which is preliminary to commenting on the action of the Junior Section of the Montreal Branch in announcing a course on Elementary Calculus and Differential Equations, as well as a course on Soil Mechanics.

The mathematics series consists of twenty lectures given by Dr. G. C. Mark and Dr. P. R. Wallace of the National Research Council in Montreal. Both instructors have a sound working knowledge of the application of mathematical methods to the solution of engineering problems. Emphasis will be placed on the practical application, it being assumed that those attending have an undergraduate training in the subject.

The series starts on January 10th in the reading room of headquarters, and will continue on Wednesday each week from 8.00 to 9.30 p.m. The whole course costs $12.00 per person.

The course on Soil Mechanics starts in February. Laboratory exercises in testing (at Ecole Polytechnique) will be included in the twenty sessions.

The fundamental physical and mechanical properties of soil will be reviewed with a view of preparing for further study. The solution of practical problems will also be considered.

The course will be given by Jacques Hurtubise, assistant-professor of Civil Engineering at Ecole Polytechnique and Guillaume Piette, Soils Engineer with the Department of Highways of the Province of Quebec. Both Mr. Hurtubise and Mr. Piette have done post graduate work in Soil Mechanics, the former at Massachusetts Institute of Technology and the latter at the University of Michigan.

All inquiries should be addressed to R. A. Frigon, Junior E.I.C., secretary, 125 Pagnuelo Avenue, Outremont, Montreal 8, or Dominion Engineering Company Limited, WA. 2701, not later than January 29.

The news of this project will be interesting to members in all parts of Canada. It is a sign of the activities in the junior section and of the enterprise of its officers. It is along these lines that the Institute should be able to do a lot for the profession. If this innovation is successful, why not extend it to other branches and to other subjects? Wouldn't this be a good means for promoting the cultural material—the humanities about which so much is heard these days as an ingredient lacking in the usual course of engineering study? Public speaking also could very well be developed by such classes. The field of prospect is very large, and there are real opportunities in this direction for an expansion of the usefulness of the Institute.

The juniors of the Montreal Branch are to be congratulated on their enterprise. Members everywhere will wish them success.

(*American Institute of Elec. Engr.*)
Dr. Charles F. Scott

AN APOSTLE OF PROFESSIONAL IDEALS GONE

Not all members of the Institute had the privilege of knowing the late Dr. C. F. Scott but all those who did will not forget him. He was present at the annual meeting of the Institute in Montreal in 1942.

Because of his contributions to the past and future of engineering in North America the Journal presents herewith a eulogy written by one of our members who knew him well.—Ed.

Few men have so impressed their professional colleagues and associates with apostolic zeal in the promotion of professional ideals as did the late Dr. Charles F. Scott, who passed away in New York City on December 17th at the age of 80 years.

Graduating from Ohio State University in 1884, he became associated with the Westinghouse Electric and Manufacturing Company in Pittsburgh from 1888 until 1911, for years as its chief electrical engineer. He then joined the staff of Yale University as Professor of Electrical Engineering, serving continuously in that capacity with great distinction until his retirement in 1932.

Dr. Scott was a past president of the American Institute of Electrical Engineers, the Engineers' Society of Western Pennsylvania, and the Society for the Promotion of Engineering Education. He was the recipient of the Edison Medal of the American Institute of Electrical Engineers and the much-prized Lamme Medal of the Society for the Promotion of Engineering Education. Several universities conferred honorary doctorates upon him.

Since the foundation of the Engineers' Council for Professional Development in 1932, into which The Engineering Institute of Canada was admitted in 1940, Dr. Scott followed with keen interest the efforts of the new organization to enhance the professional status of the engineer. While his active participation in its work was more particularly channelled through the Committee on Professional Recognition, of which he was chairman from 1938 to 1944, his enthusiasm ranged over the whole field of the Council's activities. Those who served with him on the Council or its committees will long remember his ardor in the advocacy of any measures that he thought sound. He was a missionary charged with a burning gospel in which he believed so implicitly and expounded so forcefully as to enlist the support and enthusiasm of many others.

Dr Scott was a genial and attractive figure, honoured for his wholesome enthusiasms, and a warm and constant personal friend of those Canadians who in one way or another have served on ECPD. Much of the expanding and widening appreciation of the worth and dignity of the engineering profession on this continent is due to him. C.R.Y.

WASHINGTON LETTER

President Roosevelt's Seventeenth Report to Congress on Lend-Lease Operations contains quite a lot of previously restricted news of considerable interest to engineers dealing largely with the logistics of the European campaign. The report makes quite clear the paramount role which is being played by the engineer and the technicians in mechanized war. Almost one-third of Great Britain's total building labour forces has been employed in the immense amount of new construction involved in airfields, camps, supply and repair depots and other installations in Great Britain necessary for the mounting of the European offensive. There is little doubt that a very large share of the credit for the success of the Normandy landings belongs to the two "synthetic harbours". While much has recently been written regarding this engineering feat and while the installations were featured in a recent issue of the *Journal*, the following statistics are sufficiently arresting to be repeated for the record. The three main elements of the harbours in addition to the outer breakwater of some sixty old grounded ships, were the inner breakwater of reinforced concrete caissons weighing up to 6,000 tons each and towed across the Channel—the huge steel floats moored in deep water—and the floating steel piers some hundreds of feet long which rose and fell with the tide. The programme called for two complete harbours on open beaches, each to have a capacity equal to the port of Dover. The programme involved 100,000 tons of steel and 600,000 tons of concrete, and a labour force of 50,000 men were employed in many different places in Britain in building and assembling the equipment. In twelve days the harbours were moved across the channel and put in operation. This involved a movement of over one million tons of material and half a million tons of doomed vessels that were sunk as block ships. British engineers had begun experimental work over two years ago and American scientists and engineers had joined in the work.

Some day it will be possible to write another great engineering chapter with respect to the repairing or substituting of destroyed bridges in France. There was hardly a bridge left on the whole route north from Marseilles. Virtually every bridge across the Seine between Normandy and Paris was out. Thousands of bridges in key spots all over France had been destroyed. In most instances it was the British designed Bailey bridge which came to the rescue, carrying loads some times in excess of seventy tons. The British have also extended the principles of the Bailey bridge to a unit railroad bridge.

Another item which has interested me was the decisive importance in the operations in North Africa, and recently in Normandy, of an efficient five-gallon gasoline can. These came to be known by the Eighth Army in Africa as "Jerrie-cans" and they figured largely in Rommel's early successes. The British did not have a gasoline can as good nor did they have them in the quantities required. Some of the "Jerrie-cans" were captured and sent back to England and a large programme of manufacture initiated. After El Alamein, the Eighth Army had enough "Jerrie-cans" to drive 1,500 miles across the desert all the way to Tunisia. The British programme was doubled in recent months and before D-Day many millions of these cans were ready to take the gas to Patton's and Hodge's tanks. They are designed with air pockets which allow them to float when filled and they can, therefore, be dropped from airplanes into rivers and streams and dumped off ships and barges. They are tough enough to be thrown off trucks in motion without bursting. They are designed with flush surfaces. Cargo planes, combat planes, trucks of every size, jeeps, armoured cars—anything on wheels—rushed "Jerrie-cans" of gasoline to the front lines.

Another interesting development has been the use of waste paper, pressed and treated according to a formula first developed by British technicians, to produce a 108-gallon paper gasoline tank which can be thrown away when empty. This extra gasoline carrying capacity has made all the difference in enabling aircraft to strike deeper into the heart of Germany and to afford heavy bombers increased long range fighter protection.

Turning for a moment to the campaign in the Pacific, tribute is paid by the President to Australia and New Zealand for their very extensive contribution in food and equipment on reverse Lend-Lease and the report mentions specifically the 36-million-dollar programme undertaken by Australia and New Zealand for the supply of landing craft, barges, tug boats, and other craft essential to the prosecution of an amphibious campaign over thousands of miles of ocean. When General MacArthur moved into the Phillipines, nearly ten thousand of these craft had already been delivered under reverse Lend-Lease.

The President also enlarges on the great benefits which have accrued to the free interchange of technical and scientific information between the United States and the British Empire in what he calls the "joint stock pile of brains" Radar, the jet propulsion plane, rocket projectiles and the liquid cooled Merlin airplane engine are among the examples of British initiated developments which have gone forward as the result of the pooling of the joint experience and skill of both sides.

If the logistics of modern war present a challenge to engineers, the physical reconstruction and rehabilitation necessitated by the devastation of war will present an equally complex problem. Little by little the stories are coming out of Europe of what is involved in terms of social unrest and dislocation in the destruction of utilities, transportation, power developments, factories, etc. A British observer recently returned from Europe has emphasized the difficulty of achieving any kind of political or social stability in many of the countries of Europe in their present state of dislocation. One of the difficult aspects of the situation is the fact that the Germans did maintain to a considerable degree the functioning of facilities and manufacture in occupied countries. Where necessary, food and raw materials were exported from Germany proper. In the process of taking over previously occupied countries, transportation systems have been ruined and public utilities destroyed and the exigencies of war prevents our supplying vitally needed imports in anything like the quantities that it was possible for Germany to supply under comparatively normal operational conditions. In Greece for instance, railways have virtually ceased to exist. There were literally only a few usable locomotives in Greece and something less than 100 available freight cars. In the central part of Italy at present liberated, only 10 to 20 per cent of the normal production of electric power is still available and this is largely required for such essential purposes as operating services in Rome, the pumps on the Pontine marshes and the army repairing and service depots. It is impossible to understand the political significance of many of the developments and trends in Europe unless they are seen against this background and a satisfactory settlement will not be possible until the logistics of rehabilitation have been developed to a point where they compare with the logistics of destruction.

I have had two particularly interesting interviews in the last little while in connection with the visit of an Australian senator. One was with Mr. John L. Lewis. Australia also has a coal mining problem. Another of Australia's problems is the necessity for developing power and irrigation and it was in this connection that we called on Mr. Ickes, Secretary of the Interior, who gave us information, reports and data on the vast series of irrigation projects being planned for the Western States by the Bureau of Reclamation.

The President's Seventeenth Report referred to above deals largely with Reverse Lend-Lease. It was timed to appear simultaneously with the British White Paper entitled "Second Report on Mutual Aid" and the further British White Paper entitled "Statistics Relating to the War Effort of the United Kingdom". The British White Papers, supplemented by the President's Report, depict the tremendous effort of the United Kingdom in details which it has hitherto been impossible to publicize. These are important documents and should be widely read. Mr. Leonard W. Brockington aptly remarked that the British White Papers would not only astound our enemies, but they would silence our critics.

E. R. Jacobsen, m.e.i.c.

Washington, D.C., December 22nd, 1944.

CORRESPONDENCE

Town of Mount Royal, Que.,
November 22nd, 1944.

The Editor,
The Engineering Journal.

Dear Sir:—

I wish to compliment you on publishing "Nutrition in Relation to Efficiency" in the current issue of the *Journal*. Many times in the past I have intended to write to you to say that in my opinion the general tenor of the *Journal* is too technical. Engineers have often been criticized for not taking a more active part in civic and governmental affairs, for being narrow-minded, for acting like glorified me hanics. I feel that our *Journal* reflects that attitude of mind in moving in a small world of its own. Perusal of medical, legal and even mining institute publications seems to indicate a much wider range of interests. Book reviews of historical essays, poetry (such as Major Diespecker's "Prayer for Victory"), editorials on major developments in the war and in government policy are frequently seen in such publications.

I hope that you will publish many more articles which take note of the trend of the times and which deal with subjects not strictly within the engineer's province.

I trust that you will find this note constructive rather than critical.

Sincerely,

(*Signed*) Murray V. MacDonald, m.e.i.c.

Suggestions for Improving Professional Status

No. 7 Leslie Apartments,
Griffith Street, Welland, Ontario.
December 18th, 1944.

The Editor, *The Engineering Journal.*

Dear Sir:

The letter by Mr. G. L. T. Ellis in the December issue of *The Engineering Journal* gives a clear picture of the status of the engineering profession to-day.

Many engineers feel the same as he does. We read such letters and articles from time to time, wholeheartedly endorse them, commend the writer and wish someone would take action but no one does so we drift along in our present state.

If engineering is ever to be recognized as a profession the engineer must wake up. There must be a definite line of demarcation between the engineer and non-engineer, a line which cannot be crossed unless the individual has acquired necessary qualifications. Until this line of demarcation is drawn, engineering will continue to be made up of a heterogeneous assembly from designing engineer to blue-print boy and rodman all being referred to as engineers.

The subject of the officers of the R.C.E.M.E. Corps caused long controversy and we became very indignant over some of the personnel chosen but how could we expect the army to distinguish between the engineer and non-engineer when the engineering profession itself makes no distinction. The doctor would not join the army as a captain if he must compete in civilian life with the hospital orderly and first-aid man.

The engineer keeps his profession at its present low status by endorsing non-engineers for membership in engineering societies. We cannot hope to improve our prestige until these engineers show some pride in their profession and cease this practice. Then we have the affiliate, a non-engineer who wishes transfer to membership, and endorsed by engineers is accepted. The engineering profession will never rise above its present level unless the engineer develops pride in his calling and becomes less lenient.

Thus far this letter has been one discussing the status of the engineering profession and such discussion is useless unless workable remedies are suggested and steps taken to carry them to a successful end.

Every engineer must play his part in improving the status of the profession and he can do so by practising the following suggestions:

(1) That every graduate engineer hang his degree in a conspicuous place in his office for the public to see.
(2) That he cease to criticize his fellow engineer before non-engineers.
(3) That he conduct himself in his work so he will not invite criticism.
(4) That his work no matter how menial be given technical importance by himself and his fellow engineers.

Two suggestions I would like to offer to engineering societies are:

(1) That they organize within themselves a body composed of engineers who have acquired or "organized a body of higher learning". That this body adopt and practise a code of ethics and that they wear an insignia whereby they shall be known.
(2) That the standards for membership be raised to admit only those who have acquired an "organized body of higher learning".

The employer engineer occupies a position in this scheme and without his co-operation the task may seem impossible but I am sure he will assist as it means raising the prestige of his own profession. He can do more toward improving the status of the engineering profession than the schools of engineering and engineering societies because both the graduate engineer and non-engineer must seek employment from him and if he employs graduate engineers to do engineering work and makes a distinction between engineers and non-engineers the status of the engineering profession will be improved.

Let us refer to the address by Robert E. Doherty, "The Engineering Profession To-Morrow" appearing in the August issue of *The Engineering Journal* It would be well if we read this address again and started practising the idea set forth but if we are to realize this renaissance we must take action to-day because to-morrow never comes.

Yours very truly,
(*Signed*) W. D. Brownlee, M.E.I.C.

The Engineer's Salary—a Disgrace?

December 15th, 1944

The Editor, *The Engineering Journal.*

Dear Sir:—

I have read with great interest the letter written by G. L. T. Ellis, Jr.E.I.C., which was published in the November issue of the *Journal.*

As he suggests, the trend seems to be for older engineers to take advantage of the young ones. This situation is also found in industry. Engineers have been, and are now, very much exploited by industry. The majority of us work for a salary which is a disgrace when compared to the remuneration of other professional bodies.

When a young graduate gets out of college and applies for a position, he is told by either an older professional engineer or by an industrialist that he lacks experience and therefore he cannot be paid much more than $125 or $150 per month. In the majority of cases, having obtained his engineering education at the cost of great sacrifice, he is faced with necessity and must accept the offer. He is told that if he works hard he will be promoted and obtain substantial increases in salary.

Let us now look at the course of events from then on. A few years later, having secured with great difficulty a few increases in salary, he is now approaching the $200 per month mark. Thinking that he is now starting to reap the benefits of his engineering education and is on the road to success he generally gets married. Time marches on. Five years or so out of college we see him with family responsibilities and with a salary that seems perpetually frozen at $225 to $250 per month. At this stage, if he economizes, all he can afford is to rent a modest apartment and to drive a low-priced car.

Seeing that his income is all taken up he soon realizes that something must be done about it. Two alternatives present themselves. The first is to request an increase in salary and the second is to change his position. So he approaches his superior and the answer is almost invariably an emphatic "no" with all the well-known excuses, he must wait for a promotion, he must give the job a chance, business conditions are such that an increase cannot be granted, he has a steady job under pleasant working conditions and that is worth something, it is better to have a small regular income than a large irregular one, etc. Soon he gets fed up and starts looking for another job.

He is told by his prospective employer that as he is starting in the new firm he cannot have a good salary, the reason being that it would not be fair to the boys ahead of him. Please note that this time, since the lack of experience reason cannot be given, some other excuse to keep the salary down must be found and this is the favorite one. Again he must accept a starting salary of $225 to $250 per month, accompanied by still more promises of security and a bright future. A few years later he is able, generally speaking, to obtain $300 per month and this amount in terms of engineers' salaries is indeed astronomical. From then on, if he is lucky, he will get $400 per month before he dies at the age of 60 or so years.

This, Mr. Editor, is a true picture of the financial progress of an engineer throughout life in this country. It is indeed pathetic. If the young engineering students were told these facts, no doubt many of them would quit right away. They should be told that all that can be expected out of engineering from a monetary viewpoint is an income no better than that of a small storekeeper, a wood and coal merchant, a travelling salesman or a good tinsmith. It is true that a few lucky ones, through influence or heritage, are able to better the figures given by a considerable margin but they do not amount to more than 10% of the total.

I believe this situation is caused by the fact that far too many students are admitted to engineering courses. The medical faculties everywhere restrict the number of students in the first year and the same should be done for engineering. There are 36,000 engineers in this country and industrialists know it. Every time an advertisement appears for one engineering position the number of replies averages 25. Therefore, they know that engineers are plentiful and take advantage of that fact by keeping the salaries down. The position does not necessarily go to the one best fitted for it but to the lowest bidder. If the supply of engineers was kept a little short of the demand as is the case with the medical profession, remunerations would increase substantially and working and living conditions would improve, thus making it worthwhile to practise engineering as a profession. How can the engineer live like a professional man and have influence in the community if he has not the income to do so?

Of course, industrialists may try to combat this situation by importing engineers from foreign lands. This can be taken care of by strictly enforcing the law that nobody can practise engineering or be hired in an engineering capacity unless he is a member (not an associate member or other misleading terms) of an officially recognized professional body. Positions that embody engineering work should be listed and nobody should be employed in those positions unless he is properly qualified according to law. The medical profession and the licensed electricians do it, why don't we? I can see only one reason for this and that is the apathy of our various associations. Unless we stand and fight for our rights nobody can be expected to do it for us.

For another thing the engineer talks too much. He gives free of charge technical information which cost him money to learn. Doctors do not talk for nothing, they talk only when they are paid to do it in their office, why can't engineers do likewise? Technical information should be circulated freely amongst members of the profession but should not be spread outside for poachers to take advantage of it. These poachers, half-trained and incompetent persons, fill around 5,000 jobs in this country, jobs that should be filled by thoroughly trained and competent engineers. These poachers are a menace to the engineering profession, yet many call themselves engineers, and are the cause of low salaries. They are a menace to the profession and should be got rid of by the most drastic means. They can be likened to the barnacles that cling to the hull of a ship.

Until the engineering societies are ready to use drastic means to raise the level of the engineer to that of a truly professional body there can be no hope of improvement. If nothing else is done it is the duty of the Institute, and on this I am in full agreement with Mr. Ellis, to inform all prospective students that they are intending to take a course which will give them little in the way of decent remuneration.

The following steps are therefore recommended to improve the situation:

1. Restrict the number of students admitted to first year engineering.
2. Close the profession to those who are not properly trained.
3. Stop disseminating technical information right and left free of charge.
4. Get rid of the poachers.
5. Strictly enforce existing laws like the medical profession.

Yours truly,

(*Signed*) F. Dugal, Jr.E.I.C.,
Mechanical Engineer.

Architects vs. Engineers

December 1st, 1944.

L. Austin Wright, Esq., General Secretary,
The Engineering Institute of Canada,
2050 Mansfield Street, Montreal.

Dear Sir:—

The distressing law suit between the architects and the engineers is still before the courts. As you know, there will be a small amount of rebuttal testimony and the legal arguments to be heard on December 19th. As you also know, this case has dragged through its legal course ever since mid-April 1942. There has been a tremendous amount of repeated preparation and discussion for the hearing, and it should be well known to the profession generally, that their rights have been fought for by a committee representing the Institute as well as the Corporation of Professional Engineers. I can vouch that these men, all of whom are members of the Institute, have worked throughout, with the same interest as though the case were their own.

In a somewhat different way, but in no less degree of sincerity of interest, the same should be said for those witnesses whose assistance was so necessary. All of those who agreed to help and went through the work of preparation were not heard, due to legal technicalities.

But, regardless of the general feeling that this case was an attack on our profession, I cannot help but realize the fact that I have been in the embarassing position of having to defend myself. I do not find it easy to express adequately my appreciation of the efforts of busy men who have spent many days (weeks in several instances) in assisting me to defend my business. Also to the many others who have offered their assistance and shown their interest by telephoning or writing to find out how the case was progressing. To all of these, as well as to yourself and the Council of the Institute, I can only say "Thanks."

Yours very truly,

(*Signed*) Brian R. Perry, M.E.I.C.

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 contribution 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.

MEETING OF COUNCIL

A meeting of the Council of the Institute was held at Headquarters on Saturday, November 25th, 1944, at nine-thirty a.m.

Present: President deGaspé Beaubien in the chair; Vice-President C. K. McLeod; Councillors J. E. Armstrong, R. S. Eadie, E. V. Gage, R. E. Heartz, J. A. Lalonde, P. E. Poitras, H. J. Ward; Treasurer R. E. Chadwick, Secretary Emeritus R. J. Durley, and General Secretary L. Austin Wright.

Legal Action by Architects Against an Engineer—The general secretary reported that recently he had had an interview with Mr. Brian Perry in which Mr. Perry had informed him that the evidence in the case of the Province of Quebec Association of Architects *vs.* Brian Perry was now all in and that the argument of counsel would be heard on December 19th. Mr. Perry had indicated that his lawyers were satisfied that they had been able to get into the evidence all the facts that had a direct bearing on the legal aspects of the case and were confident that a favourable decision would be obtained.

Mr. Gage inquired as to the distribution of legal costs of the case, and in a general discussion which followed it was agreed that the case was in the interests of the entire profession as well as Mr. Perry. Mr. Chadwick thought that no matter how the case was decided a move should be made to maintain the position in the construction field which had always been occupied by engineers.

It was pointed out by Mr. Armstrong that although it was indicated that the Institute should assist with the finances, it would be necessary for Council to get permission for such expenditure from the annual meeting. It was therefore moved by Mr. Chadwick, seconded by Mr. Eadie, and approved unanimously, that a resolution along these lines be presented to the annual meeting.

Employment Conditions (Collective Bargaining)—Mr. Heartz, chairman of the Committee on Employment Conditions, gave a detailed report of the activities up to date. He pointed out that a draft order for new legislation which would cover collective bargaining for professional workers had been prepared and accepted by the fourteen societies, and since had been presented by the committee of three to the Minister of Labour. They were now waiting for some decision or instructions from the minister. He also referred to two meetings which had been called by Mr. C. C. Lindsay, president of the Corporation of Professional Engineers of Quebec, in Montreal, to establish a co-operative organization to administer collective bargaining legislation for the professions in Quebec, and he asked Mr. Poitras to give the meeting further details of these developments.

Mr. Poitras referred to the two meetings called by Mr. Lindsay, stating that a sub-committee had been established to study the procedure that would be required for a bargaining agency within the province. The committee had thought that a procedure should be followed similar to that taken by the Ontario Association which had established a Federation of Employee-Professional Engineers and Assistants and was prepared to operate under the existing Order 1003.

He reported that a meeting of the committee was to take place that afternoon at which the constitution would be studied. He said that representatives of the Institute on the committee (selected by Mr. Heartz from his committee) had been asked to get authorization from the Council of the Institute to accept the constitution and also to request a loan as an aid towards the setting up of the organization. It was expected that the loan would be repaid as soon as the revenue from the federation had been established. He reported that the Corporation of Professional Engineers of Quebec had already indicated that it was prepared to make a loan for that purpose. Some question was raised as to whether or not the Council had the power to use Institute funds in this way without submitting the proposal to an annual meeting.

Mr. Heartz agreed that it was wise to be ready to take action but he wondered whether or not the new federation could do anything until a decision was made as to whether or not the new order would be passed. Mr. Poitras explained that it was proposed that the federation would operate under the existing Order 1003 for the present and until the new order was in force.

The president observed that as this was an extremely important step, and so far-reaching in its implications, he thought Council should have an opinion from the Institute's Committee on Employment Conditions.

After further discussion it was agreed that the urgency of the situation did not require an immediate decision but that Council should have a report from the Committee on Employment Conditions before taking action. This was moved, seconded, and agreed upon unanimously.

It was agreed further that if an emergency development required a decision before the next meeting of Council the chairman of the Institute's committee could notify the president who would call a special meeting for that purpose.

Rehabilitation of Members in the Armed Forces—Mr. Lalonde was strongly of the opinion that the Institute could not neglect its duty in this matter. He thought no other organization could give the members the same service as the Institute, because of the Institute's special interest in its members. The president suggested that the search for the right person should go ahead without determining at the moment where he would be located. Mr. Armstrong thought a much better job could be done by handling the Institute rehabilitation from a central office rather than attempting to do it through each individual branch.

Finally, it was agreed to continue the proposal and to establish the office in Montreal at least for the time being, and that consideration should still be given to the advantages of conducting this operation from some other location.

New Engineering Organization—The general secretary presented a report from J. B. Stirling, chairman of the Institute's Committee on Professional Interests, who, because of illness, was unable to be present. The report acknowledged the decision of Council made at Edmonton, to the effect that the proposal for a new engineering organization be referred to the Committee on Professional Interests with the suggestion that the committee consult the four provincial professional associations with which the Institute has agreements, in order to reach a decision that would be in accordance with the wishes of those bodies.

Mr. Stirling reported that he had discussed the matter with the local members of his committee and that negotiations were under way for having a full meeting of the committee, including out-of-town members, within a very short period of time.

Financial Statement: The financial statement to the end of October was presented, and it was noted with satisfaction that the revenue from fees and Journal was materially ahead of last year; expenditures, though somewhat increased, were still within reasonable limits.

President's Western Tour: The president gave a brief outline of his visit to the western branches which began at Sault Ste. Marie and finished at Victoria. In addition to the regular branch meetings, meetings were held at Atikokan (Steep Rock Iron Mines), Trail and Kelowna. He reported that the affairs of the Institute seemed to be in a very thriving condition. The reception which had been accorded his party in every centre was an indication of the esteem in which the Institute was held. He thought there was no other way in which a person could see what an integral part of the fabric of Canada the Institute was, except by visiting all the branches. He commented particularly on the dinner meeting which had been arranged by a few members of the Institute in Trail. At this meeting there were one hundred and seventy persons in attendance. He also referred to the day spent with Mr. Lorne A. Campbell, M.E.I.C., vice-president and general manager of the West Kootenay Power and Light Company, making inspections of several power developments of the company. He then outlined the itinerary from Victoria back to Montreal, which included for himself and Madame Beaubien a visit to the Grand Coulee Dam, the Boulder Dam, and also Los Angeles and San Francisco.

The president also expressed his appreciation to Mr. Heartz for accompanying him through his entire tour of the provinces, both east and west, and also to Vice-President Brereton of Winnipeg who had travelled with him from Winnipeg to Edmonton.

Mr. Heartz agreed with the president on the educational value of such a trip. He thought it would be a wonderful thing for the Institute and for the individuals if all councillors could get the real picture of the Institute that is afforded only this way.

Council Minutes to Committee Chairmen: The general secretary pointed out the desirability of sending copies of the minutes of Council meetings to the chairmen of Institute committees. Very often discussions took place, or decisions were reached, which would be of interest to certain committee chairmen. It was unanimously agreed that this should be done.

ELECTIONS AND TRANSFERS

Members

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

Bickell, William Albert, B.A.Sc. (Univ. of B.C.) and M.Sc. (McGill Univ.), Capt., R.C.E., Dir. of Works and Constrn., N.D.H.Q., Ottawa, Ont.

Cock, Cecil James, B.A.Sc. (Chem.), (Univ. of B.C.), Capt., R.C.E., 2nd-in-Command, 6th (Reserve) Field Coy., Vancouver, B.C.

Godin, Camille Rene, B.A.Sc., C.E. (Ecole Polytechnique), asst. professor of maths., Ecole Polytechnique, Montreal.

Hall, Per, B.Sc. (Civil), (Royal Tech. Coll., Copenhagen), asst. project engr., Aluminum Co. of Canada, Ltd., Montreal.

Jarmain, Edwin Roper, B.A.Sc. (Univ. of Toronto), engr., Kelco Engrg. Ltd., and proprietor, Forest City Laundry, London, Ont.

Ketchum, Verne, B.Sc. (Michigan State College), chief engr., Timber Structures Inc., New York, N.Y.

***Krassov,** Chas., B.Sc. (Civil and Chem. Eng.), Tri-State Coll. of Engrg., mech. engrg. dept., Ford Motor Co. of Canada, Ltd., Windsor, Ont.

Mokrzycki, Gustav Andrew, Dip. in Mech. Engrg. (Inst. of Tech., Lwow), Dip. in Aero. Engrg. (E.S.N.A.), research engr., Consolidated Vultee Aircraft Corpn., San Diego, Cal.

Muir, William Gordon, B.Sc. (Mining Eng.), (N.S. Tech. Coll.), plant engr., St. Maurice Chemicals, Ltd., Shawinigan Falls, Que.

Perrin, James Vincent, Ph.B. (Civil), (Sheffield Scientific School), woods mgr., Brown Corpn., Quebec, Que.

Range, George Neil, B.Sc. (Arch.), (Royal Tech. Coll., Copenhagen), Military Foreman of Works, Camp Engr. Officer, A-4, C.A.T.C., Brandon, Man.

Richardson, Frank Cockburn, B.A.Sc. (Chem. and Met. Eng.), (Univ. of Toronto), met. engr., genl. tech. dept., Aluminum Co. of Canada, Montreal.

Roddick, James Oliver, B.A.Sc. (Univ. of Toronto), pres. and genl. mgr., Russell Construction Co. Ltd., Toronto, Ont.

Worley, Harold Gordon, B.Sc. (Univ. of Toronto), asst. project engr., Canadian Industries Ltd., Montreal.

*Has passed Institute examinations.

Juniors

*Ainlay, Arthur, tech. asst. engr., Inspection Board of U.K. and Canada, Montreal.

Dewar, Geoffrey Plummer, B.A.Sc. (Univ. of Toronto), Directing Staff Officer (G.S.O.II), Cdn. War Staff Course, R.M.C., Kingston, Ont.

Dewar, Peter Stewart, B.A.Sc. (Mech.), (Univ. of Toronto), mech. engr., foundry divn., Ford Motor Co. of Canada, Ltd., Windsor, Ont.

Fox, James Clarence, B.A.Sc. (Univ. of Toronto), engr.-in-charge, stress analysis group, deHavilland Aircraft of Canada, Ltd., Toronto, Ont.

Wallingford, Vivian Miles, B.A.Sc. (Civil), (Univ. of Toronto), wartime surveys engr., grade II, Geodetic Service of Canada, Dept. of Mines and Resources, Ottawa, Ont.

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Affiliates

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Wilson, Alexander, mgr., Pumps & Softeners, Ltd., London, Ont.

Transferred from the class of Junior to that of Member

Brews, Robert William, B.Sc. (Elec.), (Univ. of Alberta), inspecting officer, fuse divn., Inspection Board of U.K. and Canada, Ottawa, Ont.

Furanna, Anthony Lewis, B.Sc. (Elec.), (Queen's Univ.), engr., instrument divn., Sparton of Canada, London, Ont.

Northover, Arthur Clinton, B.A.Sc. (Civil), (Univ. of Toronto), structl. engr., Canadian General Electric Co. Ltd., Peterborough, Ont.

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Roy, Maurice, B.Sc. (Civil), (Queen's Univ.), Major, Dominion Arsenal, St. Malo, Que.

Smith, Norman Janson Winder, B.Eng. (McGill Univ.), Lieut.-Col., R.C.E., C.R.E., 2nd Cdn. Inf. Divn., Cdn. Army Overseas.

White, William Barr, B.Sc. (C.E.), (Univ. of Man.), Capt., R.C.E., Camp Engr., No. 133 I.C., Lethbridge, Alta.

Transferred from the class of Student to that of Junior

Anglin, Thomas Gill, B.Eng. (Mech. and Indus.), (McGill Univ.), tech. asst. to L.H. & P. dept., supt., D.I.L., Nitro, Que.

Bousquet, Paul, B.A.Sc., C.E. (Ecole Polytechnique), tech. translator, General Staff, N.D.H.Q., Ottawa, Ont.

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Senneville, Claude, 1430 St. Denis, Montreal.
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Loebenberg, Leopold, Engineering Bldg., McGill Univ., Montreal.
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Wilk, Martin Bradbury, 5990 Durocher St., Outremont, Que.
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Students at University of Manitoba

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Dixon, Francis Fox, 152 Aubrey St., Winnipeg, Man.
Rempel, Cornelius, 429 Elgin Ave., Winnipeg, Man.
Sugiyama, James Shunichi, 517 Furby St., Winnipeg, Man.
Viasichuk, Harvey James, 427 Borebank St., Winnipeg, Man.

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Stevenson, David Alexander, Pine Hill Residence, N.S. Tech. Coll., Halifax, N.S.
Tuft, Edmund Moores, Pine Hill Residence, N.S. Tech. Coll., Halifax, N.S.

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

Transferred from the class of Junior to that of Member

Davis, Edgar Hawkins, B.Sc. (Civil), (Univ. of Alta.), Lieut. (E), R.C.N.V.R., plant engr. officer, H.M.C. Dockyard, Sydney, N.S.

New Brunswick

Transferred from the class of Junior to that of Member

Chapman, Harris James, B.Eng. (Mech.), (McGill Univ.), chief aero. engr., Clark-Ruse Aircraft Ltd., Moncton, N.B.

Nova Scotia

Members

Dargie, Arthur Healy, B.Eng. (Civil), (N.S. Tech. Coll.), concrete and asphalt inspector, Sternsons Labs. Ltd., Eastern Passage, N.S.
Hall, Walter E., of Truro, N.S., field engr., Foundation Company of Canada Limited, Edmundston, N.B.
Marshall, Geoffrey James, B.Sc. (Dalhousie Univ.), res. engr., Works and Bldgs. Branch, N.S.H.Q., Halifax, N.S.
Proctor, John Bertrand Cresswell, B.Eng. (Mech.), (N.S. Tech. Coll.), Capt., R.C.E.M.E., D.M.E., Tank Section, Dept. National Defence, Ottawa, Ont.

Transferred from the class of Student to that of Member

Arthey, George Clayton, B.Sc. (Mech.), (Queen's Univ.), dist. sales engr., Canadian Liquid Air Co. Ltd., Halifax, N.S.
MacCallum, Wallace Allison, B.Eng. (Mech.), (N.S. Tech. Coll.), 2nd/Lt., R.C.E.M.E., Barriefield, Ont.

Saskatchewan

Member

Slominski, Felix John, B. Eng. (Civil), (Univ. of Sask.), branch mgr., Poole Constrn. Co. Ltd., Regina, Sask.

Junior

Fyfe, John Cuthbert, B.Sc. (Civil), (Univ. of Man.), res. engr., Sask. Dept. of Highways, Regina, Sask.

BRIEF ON COLLECTIVE BARGAINING

Presented to the Wartime Labour Relations Board by the "Fourteen Societies" on January 9th, 1945

1. On April 12 last a committee representing some 14 organizations of professional engineers and scientists appeared before you and requested that such workers be excluded from the operation of P.C. 1003 at least until they had been given an opportunity of considering the effect of this law on their position in national life. They had not been consulted in the drafting of the law. You were good enough to order that such workers be excluded from the operation of the order for a period of at least six months. Pursuant to your letter of November 29, 1944, we present herein the collated views of the professional scientific workers of Canada.

2. Following our meeting with you, the Committee requested each of the organizations to inform its own members of the problems and considerations involved in this new law and to request them to indicate their individual wishes in the matter. There are some 40,000 workers in this group. The several organizations did a very good job in the matter of informing their members as to the considerations involved. The results were collected by means of individual ballots by some of the organizations and by branch meetings held across the country by other of the organizations. In gross the results indicated substantial unanimity on the part of such workers in favour of compulsory collective bargaining for professional scientific workers but by an agency of their own choosing and constituted by professional people. As illustrative of the vote, the following figures may be quoted:

92% were in favour of collective bargaining under a new Order in Council relating specifically to this group of persons.

Only 1% indicated a preference for trade unions as their bargaining agents.

3. The new order was drafted and the undersigned Committee was instructed to present it to the Government. A copy of the order which we presented to the Honourable Humphrey Mitchell, Minister of Labour, on November 8 is attached hereto.

4. The essential features of this order, which distinguish it from P.C. 1003 are:

(a) "Employee" is defined as a person employed in his capacity as a professional worker and excludes persons employed in any other capacity distinct from their professional or scientific training.

(b) "Professional Worker" is defined so as to describe the types of employees to be covered.

It includes three groups as follows:

(i) Members of the provincial professional registering bodies, and those in training for registration.

(ii) Members of national technical societies formed for the purpose of promoting the advancement of knowledge in the various scientific professions.

(iii) Those who hold degrees in several stated branches of science, or who are taking courses leading to such degrees, in or from universities or colleges recognized by the Board.

(c) It seeks to include professional employees of the Dominion Government.

(d) References to "trade unions" have been replaced by the term "employees' organizations" as descriptive of the collective bargaining group.

(e) It is proposed that a National Board (smaller than the present Board, and more directly representative of professional workers and their employers) and Provincial Boards constituted on the same principle, be set up to administer the proposed order. It is assumed that the Dominion and the provinces will make similar arrangements as under P.C. 1003 as to the body (and its personnel) to administer the order in each province and as to the classes of matters within the general jurisdiction of the National Board which are to be administered by the provincial body.

5. The following reasons are advanced in support of the proposed order:

(a) By virtue of their professional and scientific training, such employees are as distinctly distinguishable from the general body of employees as are employees belonging to a craft-union; they also possess a community of interests not shared by the generality of employees.

(b) By the nature of their work they are differentiated from the generality of employees. The duty of professional workers as defined in the proposed Order possesses the following characteristics:

(i) It is predominantly intellectual and varied in character as opposed to routine mental, manual, mechanical or physical work.

(ii) It requires the consistent exercise of discretion and judgment in its performance.

(iii) If is of such character that the output produced cannot be standardized in relation to a given period of time.

(iv) It requires knowledge of an advanced type in a field of science or learning customarily acquired by a prolonged course of specialized intellectual instruction and study, as distinguished from a general academic education and from an apprenticeship, and from training in the performance of routine mental, manual, or physical processes.

(v) It is predominantly original and creative in character, as opposed to work which can be performed by a person endowed with general manual or intellectual ability and training.

(c) It is hard to fit these employees into an Order designed for employees generally and built largely around the conventional trade unions. The Board which is to regulate collective bargaining by such employees should be directly representative of such workers and of employers of such workers. The present Board is representative of employers and workers as a whole.

(d) Professional scientific workers usually occupy a functional position which is between labour and management. Their function has primarily to do with the advising on, the reporting on, the designing of, the supervising of the construction of various projects and research, as well as the operation of various processes and the like. In performing these functions they are restricted to the use of established formulae, rules and procedures by which the facts surrounding the project in hand are measured quantitatively. They have no opinion on the project until the facts are so established. This constitutes the basic principle of the training they receive as students usually at considerable cost to the country. In the national interest nothing should be permitted to hamper efficient utilization in research and industry of that skill.

To place professional scientific workers performing such functions in a group with management or labour for bargaining purposes, would tend to reduce the efficiency with which they can perform their major function, because of the new loyalty which they would have to assume in relation to the group to which they are associated.

It is quite natural for the individual to develop loyalty to an association of which he forms a part. It is apparent that, if such workers found that they could not exhibit loyalty to the group and at the same time efficiently perform their professional function, their social position in the group would be unhealthy. The effect on creative or productive capacity of the group would be bad, to the detriment of all. If a few professional scientific workers join in an association with a large number of other workers who are not hampered by the necessity for factually analyzing the project in hand, it seems clear that they will be forced to follow the will of the majority, even if that should be contrary to the scientific facts to which they are committed.

We suggest that this is an important factual consideration which should not be valued lightly in the improvement of employment relations.

(e) We believe that professional scientific workers acting as independent units in industry in the matter of collective bargaining will be able to do much to promote improved relationships between labour and management.

(f) We are sure best results can be achieved by operating under a separate order since the effort will be free from the prejudices which have developed, not unnaturally, in the procedures followed by trade unions and management.

(g) We realize that difficulties will arise by the provision of the separate procedure, but we believe they will be fewer and the benefits greater to both labour and management.

(h) Professional workers are now organized in associations and societies throughout Canada for the purpose of disseminating technical and scientific information, establishing standards of practice, controlling the practice of the professions and disciplining their members. They have prepared and they enforce codes of ethics applicable to professional workers. All of these activities have for their object the rendering of competent and adequate technical services which are absolutely essential to the welfare, safety and health of the public. These services are distinct from those rendered by the generality of employees, and distinguish professional workers as having a community of interests which will be jeopardized if they are included in the operations of an order, with other employees.

If the professions are to serve the public as they should and as they desire to do, they may with propriety ask the Government to recognize them as a distinct element in the community as Labour is now recognized, to accord them equivalent status and privileges, and to do nothing which will jeopardize the unity of the professions. Indeed we believe our group would be negligent in its duty to the betterment of human relationships if we did not strongly urge this point of view.

(i) The Dominion Government has already recognized the validity of the principle involved by enacting a code of wartime manpower controls for professional engineers and scientists different from that applying to employees in general, and by placing the administration of these controls under the Wartime Bureau of Technical Personnel, a body set up at the request of our national scientific organizations, under the direction of the Honourable Humphrey Mitchell, Minister of Labour. The benefits accruing therefrom have been acclaimed widely by all who know the facts.

That is to say, the Government has acknowledged by a special law that professional workers, because of their training and experience, form a distinct class different from the generality of employees. By placing the operation of the Bureau in the hands of professional persons, through the medium of its administrative officers and Advisory Board, the Government has acknowledged the competency of professional workers to deal with problems in the field of their special work.

The postwar period will present problems as formidable as those now facing us. They will include many more than collective bargaining. Their solution will require the concentrated and combined efforts of all those competent and willing to attack them. Professional workers' contribution to their solution will be based upon the capacity which their training and experience has given them. To be effective, it must not be impeded by diversifying their efforts and submerging them in groups not familiar with their methods.

(j) The practice of professional engineering is controlled by law in each of the provinces. Under such laws a professional engineer may be denied the right to practise his profession. In this respect, too, the position of such professional workers differs from that of members of a trade union.

(k) The proposed Order is an adaptation of P.C. 1003 to the specific case of professional and scientific workers. No change of the basic principle or machinery is involved.

6. The hope for improvement in such relations in fields of employment lies in the greater exercise by individuals of the sense of responsibility to others in accomplishing a desired object. Responsibility for the discharge of loyalty to a group must not be placed, by law, in opposition to responsibility for recognizing and pursuing the course dictated by the facts involved in the project in hand. Professional scientific workers have an ingrained sense of responsibility to their job: to define the best way the project can be carried out successfully.

7. It is of interest here to quote a statement madè at a recent meeting of the American Chemical Society by Mr. Bernard M. Baruch, one of the outstanding leaders in the United States in organizing production in both this and the last war:

> "A trained scientific researcher thinks only of the subject he has before him; not of any ideology, not of himself, not of his publicity, not of what anybody thinks of him or his associates, not of another job—but only of one thing—what do the facts justify? How helpful it would be if we could have more trained minds to see errors, to pass judgment and guide action before it is to late.
>
> "It is hoped that in the future, even in the fields of economic, political and social matters, national and international, more of these trained scientific minds, those experienced searchers after facts, truths and realities, will be asked to help solve them."

No reflection on trade unions is implied or intended; the proposal merely reflects the fact that trade unions being differently constituted need not be invoked as agencies of collective bargaining by professional workers who are organized on the different principle of professional training.

No great loss can accrue to trade union membership, as such unions have seldom brought professional workers into union ranks as such; on the contrary it is in accordance with the spirit of P.C. 1003 that the professional workers should be free, if so minded, to select non-union agencies or to avoid agencies altogether and choose individual representatives directly.

It is of as much interest to labour as a class as it is to management as a class to have an independent body to advise on the practical possibilities of a given proposal.

9. We understand the Honourable Minister of Labour is awaiting your views before dealing with our request. In the interest of the purpose for which P.C. 1003 was enacted we strongly urge that you recommend it.

Respectfully submitted on behalf of Professional Engineers and Scientists by their officially appointed Committee.

R. E. Heartz.
W. P. Dobson.
A. E. MacRae.

Original Fourteen Societies:

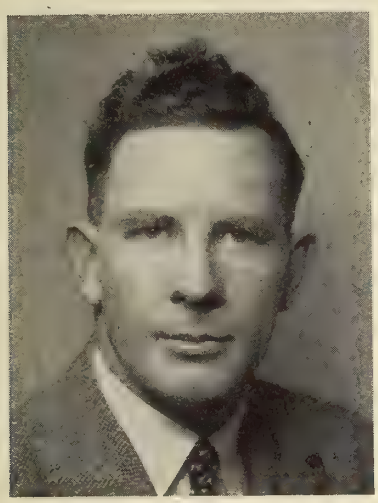
The Engineering Institute of Canada.
The Canadian Institute of Mining and Metallurgy.
Canadian Institute of Chemistry.
The Royal Architectural Institute of Canada
Canadian Society of Forest Engineers.
The Canadian Institute of Surveying.
Dominion Council of Professional Engineers.
The Association of Professional Engineers of the Province of Ontario.
Corporation of Professional Engineers of Quebec.
Association of Professional Chemists of Quebec.
American Institute of Electrical Engineers (Canadian section).
The Institute of Radio Engineers (Canadian section).
Ontario Association of Architects.
Province of Quebec Association of Architects.

Additional Societies approving the Brief:

Junior Engineers Association of Ottawa.
Illuminating Engineering Society (Canadian members).
The Professional Institute of the Civil Service of Canada.
The Federation of Employee-Professional Engineers and Assistants (of Ontario).

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*.



A. Peebles

Archibald Peebles, M.E.I.C., has been elected chairman of the Vancouver Branch of the Institute. Mr. Peebles was born at Glasgow, Scotland, in 1904. He was educated in Vancouver receiving his B.A.Sc. in civil engineering from the University of British Columbia in 1929 and his B.A. degree in 1934.

He was employed as draughtsman on construction work with various firms among which were Stuart Cameron & Co., John S. Metcalf Company, and Powell River Company. From 1929 to 1931 he worked as structural draughtsman and checker for the Dominion Bridge Company, Vancouver. He has been with the Department of Civil Engineering, University of British Columbia since 1931 when he started as instructor.

News of the Personal Activities of members of the Institute

Lieut.-Col. W. E. Phillips, M.E.I.C., has recently been appointed by the Ontario Government a governor of the University of Toronto, filling the vacancy caused by the death of F. Gordon Osler. He is head of Research Enterprises Limited, president of Duplate Canada Limited, W. E. Phillips Company Limited, Fibreglass Canada Limited, Duplate Tool and Die Limited, as well as director of the Royal Bank of Canada, Massey-Harris Company, Trusts and Guarantee Company Limited and Steep Rock Iron Mines, Limited.

Col. Phillips was born in Toronto and educated at Upper Canada College and at the University of Toronto where he received his B.A.Sc. in 1914. During the First Great War he served with the Leinster Regiment and later with the Royal Warwickshire Regiment. He was awarded the M.C. and D.S.O., and was mentioned twice in despatches, becoming a lieutenant-colonel while still under twenty-six years of age.

In 1919 Col. Phillips was loaned to the French for special work in Poland and on returning to Canada established the Phillips Glass Company in Oshawa. By the time the present war broke out he had acquired considerable knowledge and experience in glass manufacture. In 1940 when the Department of Munitions and Supply decided to organize a company for the manufacture of optical glass and optical instruments in Canada, Col. Phillips was chosen to head the company, known as Research Enterprises Limited. Recently the government appointed him a director of Turbo Research, a Crown company, which will manufacture the jet propulsion plane in Canada.

Major-General Christopher Vokes, C.B.E., D.S.O., M.E.I.C., commander of the Canadian First Division in Italy, has been made an Officer of the Legion of Honour and awarded the Croix de Guerre with palm by the French Government "in recognition of gallant and distinguished services in the cause of the Allies".

Harvey Doane, M.E.I.C., has been appointed manager of the recently formed Halifax Public Utilities Commission, Halifax, N.S. He was previously employed by the Standard Paving Maritime Limited at Halifax.

A. W. K. Billings, M.E.I.C., has succeeded the late Sir Herbert Couzens in the presidency of Canada's largest external industrial undertaking, the Brazilian Traction, Light & Power Co. For the past 23 years vice-president of Brazilian Traction and its several operating subsidiaries, Mr. Billings spends most of his time in Rio de Janeiro and Sao Paulo, where he and his company have played an important part in facilitating the industrial development of Brazil and that country's impressive industrial contribution to the United Nations' war effort.

Yvon Cousineau, M.E.I.C., of the Aluminum Company of Canada, Limited, at Arvida, Que., has been appointed secretary of the Arvida Aluminum Uses Committee. The Arvida Aluminum Uses Committee has been created to promote new industrial uses for aluminum by working them out in the plant at Arvida. Recent progress overseas has somewhat curtailed the production of this material which has played such an important role in the war. The Aluminum Company has foreseen such curtailment and is working to develop new uses for aluminum to absorb its post-war production.

Captain A. O. Barrie, M.E.I.C., is on active service with the Royal West African Frontier Force, previous to which he had been serving with the Gold Coast Light Battery in Kenya, Somaliland, Abyssinia, Gambia, the Gold Coast and Nigeria.

R. W. McColough, M.E.I.C., has resigned his positions as Director of Construction, Department of Munitions and Supply, Ottawa, and Deputy Minister, Department of Highways and Public Works, Province of Nova Scotia. He is now vice-president of Dufferin Paving and Crushed Stone Limited at Toronto, Ont.

Constructor-Lieutenant John Middleton, M.E.I.C., has joined the Royal Canadian Naval Volunteer Reserve. He has been assistant engineer with the Department of National Defence, Naval Service Headquarters, at Ottawa, Ont.

John Frisch, M.E.I.C., has recently resigned his position with the Canadian Celanese Limited and has joined the Marathon Paper Mills of Canada Limited, Marathon, Ont., in the capacity of mechanical superintendent.

Lyle McCoy, M.E.I.C., has been recently promoted to general manager of Canadian Car and Foundry Company Limited, Montreal, Que. Last spring he was elected vice-president of the company. He has been with the firm since 1916.

W. A. Dawson, M.E.I.C., has recently been appointed chief master mechanic of the deHavilland Aircraft of Canada Limited at Toronto, Ont. He was formerly associated with the Ordnance Division of the Otis-Fensom Elevator Co. Limited at Hamilton, Ont.

William Watkins Downie, M.E.I.C., has resigned his position as buildings engineer with the Maritime Telegraph & Telephone Company Limited at Halifax. He has recently been appointed buildings engineer with the Board of School Commissioners for the City of Halifax.

Squadron Leader Kenneth Y. Lochhead, M.E.I.C., has recently been promoted from the rank of flight lieutenant and is now in charge of engineering development work on trainer type airplanes at R.C.A.F. Headquarters, Ottawa, Ont.

V. W. Dick
Secretary, Annual Meeting Committee, Winnipeg

Weston E. Weatherbie, M.E.I.C., who has been employed with the Aluminum Company of Canada at Shipshaw, Que., has accepted a position as yard foreman with the Bathurst Power & Paper Company, Bathurst, N.B.

Allan D. Nickerson, M.E.I.C., a former chairman of the Halifax Branch of the Institute, has resigned his position as transmission engineer with the Maritime Telegraph & Telephone Company Limited at Halifax, N.S. He is now with the Bell Telephone Company of Canada at Montreal, Que.

Rosaire Saintonge, M.E.I.C., of the Consolidated Paper Corporation, has been transferred from the Port Alfred mill where he was assistant division engineer to the woodlands department at Grand'Mère, Que., as woodlands logging engineer.

Joseph D. Kline, Jr.E.I.C., formerly with the Pickering works of Defence Industries Limited, is now employed as designing engineer with the newly formed Halifax Public Utilities Commission, Halifax, N.S.

Flying Officer Graham R. Treggett, Jr.E.I.C., has recently been promoted from the rank of pilot-officer and has been posted overseas.

E. L. Miller, Jr.E.I.C., is now with the Jamaica Bauxite Company at Manderville, Jamaica, B.W.I.

W. S. Raynor, Jr.E.I.C., of Canadian Car & Foundry Company Limited, has been transferred from Amherst, N.S., to the St. Laurent plant at Montreal, Que., as executive engineer.

J. N. McCarey, Jr.E.I.C., is now employed as engineer with the Canadian International Paper Company at Hawkesbury, Ont. He was formerly with the Stephens Adamson Manufacturing Company of Canada Limited, Belleville, Ont.

Melvin Lee Zirul, Jr.E.I.C., is at present with the Powell River Company, Powell River, B.C.

Ralph T. Morgan, Jr.E.I.C., who has been with the Canadian International Paper Company at Three Rivers, Que., is now with the New Brunswick International Paper Company at Dalhousie, N.B.

G. E. P. Eastwood, S.E.I.C., who has been engaged in geological mapping with the Geological Survey of Canada, is now employed in the research department of the Hudson Bay Mining and Smelting Company at Flin Flon, Man.

Obituaries

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

Francis Bell Reilly, M.E.I.C., died on November 22nd, 1944, at his home in Regina, Sask. Born at Wardsville, Ont., on May 17th, 1874, he received his education there and in Regina.

For a number of years after moving west, Mr. Reilly taught school in the Wolseley and Regina districts. In 1909 he joined the architect firm of Reilly, Dawson and Reilly and was in charge of different architectural undertakings as well as assisting in general survey work. He had joint responsibility in preparing plans and superintending buildings such as Westman Chambers, Regina, and Central and Elmwood Schools, Swift Current, and various other structures throughout the province. In 1934 he became a partner in the firm of Reilly and Crowther.

Mr. Reilly was associated with the Regina library board for 27 years, being chairman from 1923 until he retired in 1943. A prominent Mason for many years, Mr. Reilly was grand master of the Masonic Lodge of Saskatchewan in 1932-33 and was provincial prior and grand constable of the Grand Priory of Canada.

Mr. Reilly joined the Institute as an Associate Member in 1918 becoming a Member in 1940. He was made a Life Member in 1943.

Cecil Middleton Ross, M.E.I.C., died on November 29th, 1944, at the Western division of the Montreal General Hospital after a short illness. Born at Scotstown, Que., on January 13th, 1886, he received his education at Ottawa Collegiate and at McGill University from where he graduated in 1908 with a B.Sc. in mining.

For the two years following graduation Mr. Ross worked as assayer-engineer with the Crown Reserve Mining Company in Ontario after which he did surveying and contracting in British Columbia. From 1914-1919 he served with the Royal Canadian Engineers overseas ending his service with the rank of captain. After the war Mr. Ross worked in the mining department of the Manitoba Bridge & Iron Works at Winnipeg for one year when he was engaged as engineer in charge of the "Core Wall" Twin Falls development of the Abitibi Paper Company for the contractors Morrow and Beatty. In 1920 Mr. Ross joined the Mathews Conveyer Co. Limited, Montreal, as district engineer for the designing, selling and installing of Conveyer systems in the province of Quebec. He remained with this company until the time of his death. His mining activities were well known across the Dominion and included the C.N.R. tunnel under Mount Royal.

Mr. Ross joined the Institute as a Member in June, 1944.

Beresford Henry Segre, M.E.I.C., a survey engineer with the Mines and Resources Department for many years, died in Ottawa on November 15th, 1944. Born in Jamaica, B.W.I., on February 19th, 1886, he received his B.A.Sc. degree at the University of Toronto in 1913.

After graduation Mr. Segre entered the service of the Dominion government as chief of party on Dominion Land Surveys, and in 1915 he enlisted in the First Great War. He served overseas with the Royal Engineers as a lieutenant being Works Officer R.E. at Baku, Russia. In 1920 he returned to work for the government and two years later left Ottawa to conduct the survey of the Mackenzie River, N.W.T., shortly after the discovery of oil at Norman Wells. Commencing at Norman Wells he continued to the Arctic coast and wintered at Aklavik, then a mere settlement, continuing the delta survey the following summer. He had been with the Department of Mines and Resources for 24 years.

Mr. Segre joined the Institute as Associate Member in 1921 becoming a Member in 1940.

News of the Branches

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

BORDER CITIES BRANCH

W. R. Stickney, M.E.I.C. - *Secretary-Treasurer*
G. W. Lusby, M.E.I.C. - - *Branch News Editor*

The regular monthly meeting of the Border Cities Branch was held at the Prince Edward Hotel on October 20th, with J. B. Dowler, chairman of the Branch, presiding.

The speaker of the evening was Mr. George Long, historian for the Bell Telephone Company of Canada, whose subject was **Giving Wings to Words—To-day and To-morrow.**

Mr. Long stressed the importance of communications in modern warfare and stated that the early battles of this war were lost because of inadequate communication systems. Since then great strides have been made in developing and perfecting special telephone equipment to meet the requirements of the armed services with the result that over 2,000 patents on telephone equipment alone have been made in the last three years.

The modern battleship requires as many phones as a city of 10,000 people and the B-29 super fortress bomber carries over 2,000 lbs. of radio equipment.

One of the recent developments in radio equipment is an electrical anti-aircraft locator. This automatically calculates the speed of the plane, its elevation, drift, makes allowances for wind and will bring down an enemy plane with one shell where formerly 17,000 were required.

New transmitters were developed which in the laboratory were the most efficient possible but in actual practice they picked up too many undesirable sounds. Finally these difficulties were overcome and now the standard telephone transmitter is the receiver which was developed in peacetime as an aid to the deaf. This is made possible by a new metal called permalloy that has very little residual magnetism and reduced the size of the magnet required in the receiver and transmitter. It has also reduced the size of conductance coils in telephone work and in two years this item alone has saved the Bell Telephone Company over $200,000,000.

Mr. Long brought with him a very interesting display of actual pieces of equipment for demonstration purposes.

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The monthly meeting was held at the Prince Edward Hotel on November 17th with J. B. Dowler, chairman of the Branch, presiding.

The speaker of the evening was Major G. G. M. Carr-Harris, Deputy Assistant-Director, (Tanks and M.T.), Inspection Board of United Kingdom and Canada, who presented a very interesting paper entitled **The Combustion Turbine.**

EDMONTON BRANCH

G. H. Milligan, Affil. E.I.C. - *Secretary-Treasurer*

A most interesting address was heard at the meeting of the Edmonton Branch on November 14th, at which Mr. D. D. Morris, general manager of Alberta Nitrogen Products Limited, Calgary, spoke.

Mr. Morris' subject was **The Operations of the Alberta Nitrogen Products** and, in an address amply illustrated with charts, he pointed out many interesting features in connection with the manufacture of ammonia, noticeable among which was the high compression of the gases necessary in this process. Mr. Morris pointed out that in the production of ammonia the first stage is a compression of 1,700 pounds which eventually is increased to 5,000 pounds in the final stage. The speaker mentioned that at present whereas the plant is shipping ammonia to various explosive plants in Canada, their chief output is that of ammonium nitrate as fertilizer which, due to present war conditions, occupies a position of highest priority.

Among the problems encountered was corrosion of water cooling pipes due to the presence of iron eating bacteria in the Bow River water due to the fact that the Nitrogen Plant intake is below the sewage disposal of the City of Calgary. This was overcome by chlorination, but insomuch as the water consumption is something in the order of 400 second feet the consumption of chlorine is exeedingly heavy. Another problem mentioned by Mr. Morris was the pulsation caused on the power system of the supply company by virtue of the compressors operating at certain loadings. It was suggested that the addition of fly wheels to the motors would possibly ccrrect this condition.

The speaker was suitably thanked by W. Porteous of the University of Alberta.

The meeting was under the chairmanship of B. W. Pitfield.

HALIFAX BRANCH

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

The regular monthly dinner meeting was held at the Nova Scotian Hotel on Thursday, November 23rd. Chairman G. J. Currie presided.

Following dinner Mr. Currie opened the meeting by introducing J. B. Hayes, manager of the Nova Scotia Light and Power Company, Limited, who gave some of the highlights of the subject of the evening, the subject being **The New 12,500 Kilowatt Steam-Electric Station** recently completed in Halifax by the above mentioned company.

Mr. Currie then introduced John T. Farmer, mechanical engineer of the Montreal Engineering Company, Limited, and J. W. MacDonald, of the Nova Scotia Light and Power Company, Limited, who was the resident engineer during the construction of this new plant.

With the aid of lantern slides Mr. Farmer showed comprehensive graphs which gave evidence of the necessity of increased capacity. Mr. Farmer's talk presented a very complete picture of all the various aspects of the design and construction of the plant.

Mr. MacDonald then carried on with the slides which showed the main stages of construction from commencement to completion. In his comments covering these slides Mr. MacDonald gave most interesting information, as well as mentioning the difficulties encountered.

It is a fine tribute to the engineers working on this project that the actual figures confirmed the expected performance of the boiler and turbine units, and further that one pound of coal will produce one kilowatt hour, which is a record in Canada.

The guests, 135 in all, including several senior students of the Nova Scotia Technical who were guests of the Branch, were presented with a copy of the paper covering the details of the station.

The meeting was then formally closed and those present adjourned to the new station for a tour of inspection. The crowd was divided into small groups, each under the guidance of one of the company's engineers. This added greatly to the success of the inspection, which incidentally was the first inspection of this type to be made through this station.

We are in no small way indebted to the Nova Scotia Light and Power Company, Limited, for a very successful meeting, and all efforts in this respect are greatly appreciated.

HAMILTON BRANCH

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

Thursday, November 16th, was the occasion of a gathering of 180 members of the Hamilton Branch and their guests at a Ladies' Night dinner meeting; H. A. Cooch, branch chairman, presided.

The speaker of the evening was Dr. Samuel G. Hibben, Director of Applied Lighting, Lamp Division, Westinghouse Electric and Manufacturing Company. Dr. Hibben, who has spent many years in a constant search for new kinds and applications of light and who has lectured on lighting subjects throughout the United States, Canada, England, France and Holland, chose for his subject, **How Illuminants Are Born.**

Dr. Hibben outlined the potentialities of visible and invisible light of various wave-lengths and traced the developments which had resulted in utilization of more and more of the spectrum above and below those wave-lengths which produce direct response in the human eye—visible light.

The phenomenon of luminescence first received the attention of scientists, and the development of synthetic "phosphors" ultimately resulted in the present fluorescent light. Dr. Hibben demonstrated several new types of fluorescent lamps, of which many variations in size and form will be available to the public after the present conflict.

Ultra violet light is even now playing an important part in the war effort—such as providing for aircraft perfect instrument illumination which is invisible to hostile craft. Prospecting by means of "black light" has lead to important discoveries of calcium tungstate ores.

Discussing the almost unlimited possibilities of the post-war field of illumination Dr. Hibben effectively demonstrated numerous innovations such as heat lamps, emitting visible and invisible rays which will add greatly to the comfort and health of future populace. Heat lamps for cooking in which the entire energy output of the lamp is converted into heat in the food itself were shown to be entirely practical when Dr. Hibben expertly cooked an egg and several rashers of bacon.

New steam lamps properly controlled will provide an automatic means of humidifying homes.

Homes of the future will have easily varied colour schemes, changes being made merely by turning on lamps of the desired colour combination. Wall papers, curtains, drapes, table linen, when properly treated, will exhibit certain patterns under the influence of white light and will glow with rich colour and pattern under excitation of ultra violet light.

In his talk Dr. Hibben made use of much equipment in actual demonstrations of the many astonishing types of illuminants which will be available in the future.

Dr. Hibben was introduced to the assemblage by G. F. Mudgett, Manager of the Illumination Division, Canadian Westinghouse Co., and was thanked by N. Eager, vice-chairman of the Branch.

LAKEHEAD BRANCH

J. I. Carmichael, m.e.i.c. - *Secretary-Treasurer*
R. B. Chandler, m.e.i.c. - *Branch News Editor*

At a dinner meeting on Friday evening November 10th 1944, some 40 members of the Lakehead Branch were addressed by Mr. A. H. Frampton, assistant chief electrical engineer of the Hydro-Electric Power Commission of Ontario.

Mr. Frampton spoke on **The Steep Rock Iron Mine —Its General Features and Power Supply.** The address which was illustrated by excellent slides was followed by the showing of a coloured motion picture depicting the programme of development work undertaken at Steep Rock Mine, including the diversion works carried out to de-water the lake overlying the ore bodies.

The address was most interesting and well received. S. T. McCavour, chairman of the Lakehead Branch, presided at the dinner and introduced the speaker. W. L. Bird and L. B. Hulko expressed the thanks of the meeting to Mr. Frampton.

LONDON BRANCH

A. L. Furanna, m.e.i.c. - *Secretary-Treasurer*
G. N. Scroggie, m.e.i.c. - *Branch News Editor*

Flood Control in the Muskingum Conservancy District of Ohio was the subject of the address by W. R. Smith, Middlesex County engineer, at the December meeting of the London Branch on December 13th. Mr. Smith was one of a party chosen by the Department of Planning and Development of Ontario to visit the Muskingum District to learn of their practices in developing methods of flood control in that area, having in mind the need for similar projects in certain river valleys in the province.

The speaker pointed out the geological similarity between the Muskingum and the Thames River districts by the use of coloured slides, aerial views and maps. He stressed the proper use of land by contour plowing, terracing, strip cropping and reforestation, as well as by control dams, as being essential in any successful conservation scheme. Sodded slopes, alfalfa crops and mixed or deciduous trees, rather than coniferous, were better aids in reducing runoff.

The amount of runoff and top soil erosion has been accurately measured in the Muskingum District, and Mr. Smith gave statistics showing the alarming loss of top soil and the steady lowering of the water table where improper farming methods were in use.

If fifty picked farmers were given the opportunity of visiting this Ohio conservancy district to learn the practices and methods of land use in that area, they could see for themselves the great benefit by these proper practices and on their return to their own farms each would be able to produce object lessons for their neighbours and by this means conservation in any Canadian river valley area would start at once.

In thanking Mr. Smith for his paper, W. G. Ure commended the provincial department for their selection of Mr. Smith as a member of this group as he will be able to bring to engineers generally the results of his studies, and the London Branch feels honoured in being represented.

MONTREAL BRANCH

L. A. Duchastel, m.e.i.c. - *Secretary-Treasurer*
H. H. Schwartz, jr.e.i.c. - *Branch News Editor*

On Thursday, November 2nd, the Montreal Branch listened to a talk by Mr. E. R. Complin, industrial relations manager for C.I.L and D.I.L. C. A. Peachey was chairman of the meeting.

Mr. Complin graduated in civil engineering from the University of Toronto in 1926 and since then has devoted most of his time to personnel work. His subject **Industrial Relations—Human Engineering** was therefore approached from two angles, that of the engineer and that of the personnel worker.

To-day the problem of labour has come to the fore as one of the most important problems of management. Inasmuch as during the postwar period the selling price of the product will be fixed while raw materials, overhead and other manufacturing costs will be raised, it will be necessary to cut labour costs.

This can be done in either of two ways: (a) by cutting wages, a course certain to cause strife and unrest in the country, or (b) by increasing the productivity of labour. If course (b) is followed it may even be possible to increase wage rates still further, rather than decrease them.

In order to increase the productivity of labour, it is essential to realize that the workingman is a human being, with human wants, desires and needs. It is a good administrator who recognizes these facts and properly applies them. Administration is the art of getting the right people to do the right thing at the right time.

Mr. Complin pointed out that the engineer dealt as much with humans as with inert materials, and that both were amenable to scientific laws. The engineer's training should fit him to handle both with equal facility.

On Thursday, November 16th, Mr. Jean Asselin, a graduate of Ecole Polytechnique and city manager of Three Rivers, addressed the Montreal Section on **The City Manager Plan,** discussing the aims and necessities of a city manager. Raymond Matte was chairman of the meeting.

One of the principal advantages of the city manager plan is the unification of authority and responsibility. The city manager is entrusted with the carrying out of all legislation passed by the city council. He must prepare plans, co-ordinate and supervise the work of all municipal departments.

An important point is that the city manager is responsible to council and since the council is itself responsible to the voters there is little danger of dictatorship by the manager. However, since the manager has the authority necessary for the carrying out of his orders, it is not possible to "pass the buck" when something must be done.

One comment by Mr. Asselin aroused a great deal of discussion. He stated that 30% of the city managers are engineers. The question was then immediately raised as to the reason why the city managers are not all engineers and whether this would not prove a fruitful field for the engineering profession. Mr. Asselin replied that undoubtedly the engineer could and would do a good job as a city manager, but that more was required than technical ability only. The city manager must be able to co-ordinate many people's activities. He must be able to withstand pressure from many and varied political groups and still make decisions based upon mature judgment. This is the reason why city managers in the larger cities are lawyers, financiers, etc. In the smaller communities where finances are limited the positions of city manager and chief engineer are frequently combined.

The city manager plan is occasionally opposed by organized politicians, since it tends to shear from them a large amount of their patronage. From the citizen's viewpoint, this is all to the good since what the citizen demands is efficient and honest government. Experience has shown that a city manager fulfils these requirements very well.

Reported by Eli. L. Ilovitch, s.e.i.c.

On November 23rd the members of the Montreal Branch were shown sound films on the manufacture of ball bearings. The films were produced by the New Departure Bearing Company. Mr. H. Little, vice-president and sales manager of R & M Bearings, Montreal, was the guest speaker.

The audience was shown how carefully the steel was made so that a perfectly uniform product was given to the consumer. The different steps in the rolling of the steel were described. The steel was annealed before being fed into the ball forging machine which cuts off a pre-determined length of steel rod and wedges it between cup-shaped dies so that an almost perfect sphere is formed. The balls are then rough ground to leave just enough material for hardening and grinding. It was shown that the movement of the ball grinding machine can be compared to that of a man rolling a clay ball between the palms of the hands. After grinding, polishing and lapping the balls are tumbled with leather into wood tumbling barrels. They are then gauged and grouped into sizes to within 1/10,000 of an inch and assembled in the finished bearing.

Both inner and outer races are hot forged from round bar stock. This forging operation tends to form the steel into a more compact texture which is advantageous in bearing races. The end of the bar is heated and then upset, after which the bar is pierced so that very little material is wasted. The races are rough turned on their inside and outside diameters and they are also faced, leaving enough material for hardening and grinding.

An oscillating grinding head forms the actual ball tracks and makes it unnecessary to have a true ball radius on the grinding wheel. Automatic gauges guide the cutting wheel so that the proper final dimensions are kept. Frequent and careful inspection and cleaning is carried out so that the final product is as nearly perfect as it is mechanically possible to produce.

Another film by the same company showed the care that is taken to keep the bearings clean at every stage of inspection and packaging. Air-conditioned workrooms, clothes made of synthetic fibres that are lint-free, and no human handling of the balls or races were some of the reasons why bearings reach us in such good condition. The audience was asked to exercise a reasonable amount of care in handling and installing the bearings to keep the excellent service that was built into them.

"One battleship requires 2,200 telephones—enough to serve a city of 10,000 people," declared George L. Long, historian of The Bell Telephone Company of Canada, speaking on **Giving Wings to Words—To-day and To-morrow** at the meeting of the Montreal Branch on November 30th.

Illustrating the immense quantities of signals supplies needed overseas, Mr. Long also pointed out that the cost of radio-telephone and radar equipment carried by 2,000 bombers is greater than the cost of all broadcasting stations in the United States.

The speaker also demonstrated the properties of certain crystals which are used to control the frequencies of radio transmitters in tanks. During a battle, he said, hundreds of messages may be radioed back and forth, yet none interferes with any other, because each is kept in its own channel by means of these crystals.

Some tanks have as many as 80 crystals in their radios. By pushing a button, a tank commander can switch from one channel to another, talk to other tanks, call for artillery support, hear warnings from aircraft overhead, or check with headquarters for further orders.

One manufacturing company alone, Mr. Long revealed, delivered eight million crystals to the armed forces last year at a cost one-twentieth that of crystals produced before the war.

Discussing the electrical gun director developed by telephone engineers, Mr. Long said only 24 per cent of the robot bombs, which travel between 350 and 400 miles per hour, get past the gun batteries equipped with electrical directors.

"The most significant development in this war over the previous conflicts was the ease of communications," the Bell Telephone Company historian said. He explained how the wireless telephone has changed the form of air fighting and made possible the success of the United Nations air power.

"Men like Group Captain E. A. Macnab and Wing Commander Gibson, V.C., have declared that they have as much control over their squadrons in the air now as did the cavalry officers over their cavalry units," Mr. Long said. "It is possible to talk to one or all planes in the squadron while in the air as well as talk to the commander at the home base."

He quoted a statement of an Allied general, that modern army, without field radio and telephone communications, would be confused and helpless, and he said that during the first 21 days of the invasion of Italy, signal corps units installed a total of more than 5,300 miles of assault telephone wire, field wire and cable—an average of over 240 miles of line laid a day.

Demonstrations were given of Canadian and German army field telephones and of the R.C.A.F. and United States Army Air Force microphone to show the efficiency of these instruments and it was stated that equipment used by our men was second to none.

To show how this efficiency has been attained, Mr. Long demonstrated the sensitivity of special metal alloys being used in the equipment as well as the power of the most modern magneto.

He also demonstrated an electronic tube photo-electric cell by having it pick up speech and music which was transmitted on a beam of light. The modern application of this in wartime is the transmission and reception of radio pictures which appear in the newspapers a few hours after they have been taken on the fighting fronts.

"Many developments for war purposes become useful to mankind in peacetime," Mr. Long said, predicting great benefits when the scientific knowledge gained in this war is put into peacetime pursuits. However, he dispelled the idea that Utopia could be brought automatically after the war and warned against too much optimism in this regards.

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On Thursday evening, December 7th, 1944, the members of the Montreal Branch spent a different kind of evening at the Institute. Four Engineering students were the speakers, two from McGill and two from the Ecole Polytechnique, Montreal. There were cash prizes given for the best and second best papers. K. G. Cameron, C. E. Gelinas, and L. H. Burpee were the judges.

The first prize was won by Denis Noiseux, S.E.I.C., 5th year Ecole Polytechnique, for his paper on the **Analysis of True Unit Stress of Copper.** He showed how it was possible, without any special equipment, to find the true unit stress in the metal. By stressing a test specimen to destruction, measuring the diameter of the neck at the break by micrometer, and then applying his formula, he was able to solve his problem. These results were checked several times and were found to be correct.

The second prize was taken by Louis A. Dion, S.E.I.C., 4th year Ecole Polytechnique, for his paper on the **Design of an Explosion-Proof Concrete Wall.** Mr. Dion had spent a summer or two working for the C.I.L. plant, Brownsburg, Que., where he had opportunities to help in the design of several powder manufacturing buildings. His paper mentioned some of the problems involved and also showed a novel way of placing reinforcing steel in the concrete structure. The building he discussed had a hinge-type roof so that any explosion might be deflected upwards and so lessen the resultant damage.

G. H. Y. Slader, S.E.I.C., 4th year Mechanical Engineering, McGill, read a paper on **The Development of Power at Back River.** P. J. Robinson, S.E.I.C., 3rd year Mechanical Engineering, McGill, gave an interesting paper on **The Realization of a Dream.** He told how over a period of five or six years there was built and equipped a laboratory in a 10′ x 10′ concrete building near his home. It has an electrical, a biological, and a chemical department with the added feature of a reflecting telescope on the roof for the study of astronomy.

All the speakers were given a free Student Membership for the coming year. K. G. Cameron presented the prizes to the winners.

William D. Fleming, S.E.I.C., was in the chair during the speeches and the discussion which followed.

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On Thursday evening, December 14th, Mr. C. M. Lafoon of the Westinghouse Electric and Manufacturing Co. presented a paper on the **Development of Waterwheel Generators** to the Montreal Branch.

In tracing the development of these machines he told the meeting that the construction of large dams and waterwheel generators was largely due to the efforts of government agencies although private enterprise played a considerable role. A number of generator units were under construction in the U.S.A. when the war broke out, and these have since been completed, but new projects have been deferred until after victory. The new projects, he believed, would be the development of the Missouri river valley in the United States and the St. Lawrence river valley in Canada.

In his paper he mentioned some of the difficulties encountered in the operation of waterwheel turbines and generators, and spoke of the work that is being done to overcome them. The problems of the thrust bearings are now undergoing extensive investigation and a full report on the subject is expected to be published in the spring. Corona, he said, has been greatly reduced by the use of conducting varnishes in quantities so limited that short circuiting does not occur. The demand for high temperature insulation is being met by the use of fibre glass and a new series of plastic resins based on the silicon oxygen chains instead of the usual carbon chains. Laminations are now being made of cobalt steels resulting in higher efficiencies.

A lively discussion followed the meeting. The chairman was McNeely DuBose.

NIAGARA PENINSULA BRANCH

J. H. Ings, M.E.I.C. - - *Secretary-Treasurer*
J. L. McDougall, M.E.I.C. - *Branch News Editor*

The second of the season's meetings of the Niagara Branch was held in St. Catharines at the Leonard Hotel on November 16th. The dinner meeting, the usual custom of the Branch, was especially well attended and Chairman W. D. Bracken welcomed some 60 members from the surrounding districts of Niagara Falls, Welland, and Port Colborne.

J. H. Ings introduced the speaker of the evening, Mr. A. H. Frampton, assistant chief electrical engineer with the Hydro-Electric Power Commission, who chose as his subject **The Steep Rock Iron Mine—Its General Features and Power Supply.** From his first-hand experience in following the development in recent years, his remarks added much to what has already appeared in papers which have been printed from time to time in the *Journal* about this important and unusual development.

Besides the photographs used to illustrate his talk, the coloured movies were of special interest as these, combined to give a visible idea of the size of the undertaking that has now been completed and has made possible the ore shipments to date.

Mr. Frampton remarked that as far back as 1891 large ore deposits were thought to exist under the deep 15 mile long lake. In connection with the above scheme the Hydro has now supplied the power to make possible the development of the Steep Rock Iron Mine. That power supply to this area was a problem in itself and was clearly shown, involving the tie-in and operation to a line of some 400 miles in length from widely dispersed available sources.

At the close of the lecture, H. E. Barnett expressed the appreciation of the members present and thanked Mr. Frampton for his most informative talk.

OTTAWA BRANCH

A. A. Swinnerton, M.E.I.C. - *Secretary-Treasurer*
R. C. Purser, M.E.I.C. - - - *Branch News Editor*

On November 7th, 1944, Past-President K. M. Cameron, Branch Chairman W. L. Saunders and Secretary-Treasurer A. A. Swinnerton called on Mrs. G. J. Desbarats and, expressing regrets that it had not been possible to present the Julian C. Smith medal to Mr. Desbarats in person, asked her to accept it as a token of the esteem in which her late husband had been held by his fellow engineers. She replied suitably and gave some interesting reminiscences of Mr. Desbarats' official life.

PETERBOROUGH BRANCH

Eric Whiteley, Jr. e.i.c. - *Secretary-Treasurer*
J. F. Osborn, Jr. e.i.c. - - *Branch News Editor*

Wrought Copper and Its Alloys was the subject of a paper by Mr. G. S. Mallett, technical supervisor of the Anaconda American Brass Company, at the meeting of the Branch on November 2nd. Mr. Mallett's firm is the only one engaged in the manufacture of wrought copper alloys in Canada and he is, therefore, in an exceptionally good position to know this product as it is related to Canadian industry.

Since it occurs in metallic form copper was one of the first metals to be worked and its history extends back several thousand years. Native copper frequently contained other elements which imparted properties similar to modern alloys.

By far the largest use of copper is in the electrical industry which requires a pure electrolitically refined product. Other applications take advantage of the corrosion resistance and workability of copper and its alloys. The principle alloying elements used singly or in combination are zinc, tin, nickel, lead, aluminum, silicon, manganese, cadmium, berrylium, selenium and tellurium. The various categories—brasses, bronzes and specific alloys—were described and identified with their more common characteristics. For most purposes the alloys are cast in cakes and bars from which form they are rolled, extruded and drawn into sheets, bars, tubes, etc.

Much material is now bought to specifications, some covering chemical composition and some physical properties. It is not practicable to expect to buy finished material to conform rigorously to both of these but it is possible to manufacture closely to one or the other. In connection with specifications it should be borne in mind that most of them cover minimum acceptable standards and may be below standard commercial ...e.

...time substitutes were discussed with respect to ...dvantages and deficiencies. Mr. Mallett is of the ... that, as far as the copper industry is concerned, ... in most cases revert to pre-war alloys as soon ...l range of elements is available.

...owing a lively question period a vote of thanks ...oved by W. T. Fanjoy on behalf of those present.

QUEBEC BRANCH

...ustave St. Jacques, m.e.i.c. - *Secretary-Treasurer*
...eo Roy, m.e.i.c. - - - *Branch News Editor*

... December 4, 1944, Mr. Huet Massue, statistical ...eer of The Shawinigan Water & Power Company ...ssed the members of the Quebec Branch at the ...ty of Sciences of Laval University.

...pplementing his talk with splendid coloured ...ts, Mr. Massue spoke on **The Population of ...ebec and its Place in the Economy of Canada.** ... subject dealt with the distribution of the popula...n, its growth, age, origin, birthplace, language, ...banization, education, health and occupation.

From the many conclusions derived, the following were the most outstanding:

1. Because of the fact that the population of Quebec is increasing more rapidly than that of other parts of Canada, the importance of Quebec in the Canadian scene is growing and it becomes a duty for Quebec to contribute in the widest possible measure to the progress and development of Canada.

2. The particular characteristics of the large majority of the population of Quebec and its birthright obtained from two centuries of residence in America, results in the fact that it cannot always look upon the problems facing Canada in the same light as do the other citizens of the country.

4. The fact that some 2,000,000 Quebecers of French origin do not speak English creates a problem in itself and prevents them to view many questions in their true national aspect. The same applies however to other parts of Canada where few Canadians speak French (3% in B.C., about 6% in the Prairies and less than 10% in Ontario). If there were more bilinguists of English origin it would help the situation considerably. They would be so many more apostles of good understanding and mutual comprehension.

5. Needless to repeat here, the urbanization of Quebec has created a most dangerous artificial situation. Let it be remembered that before the depression which preceded the present conflict, 240,000 or 28.5% of the population of Montreal was on relief and that, even in 1939, immediately before the war there were still 160,000 persons in the urban centers of Quebec depending on state relief for their living.

7. Each year in Quebec, more young men join the ranks of the army of workers than anywhere else in Canada. This adds to the seriousness of the employment problem. It is a fact that, so far the trend has favoured the industrialisation of the region of the Great Lakes to the detriment of other parts of Canada. The same phenomena has taken place in the United States to the detriment of the eastern part of the country.

8. Facts also indicate that industry in Quebec is altogether different from that of Ontario and that because of its particular nature, it cannot permit the salaries and wages paid in Ontario.

9. If the employment problem is to be helped and wages and salaries increased in Quebec, foreign capital will have to be attracted and more remunerative industries developed. It must also be remembered that no efforts must be spared to transform into peacetime enterprises the industries developed during the war.

SASKATCHEWAN BRANCH

Stewart Young, m.e.i.c. - *Secretary-Treasurer*

The Saskatchewan Branch met jointly at dinner with the Association of Professional Engineers in the Kitchener Hotel, Regina, at 6.30 p.m. on Friday evening November 17, 1944. Thirty members and guests were in attendance. The branch chairman, J. McD. Patton, presided.

Immediately following the dinner the Convenor of the Committee on Professional Interests made an interim verbal report particularly on data collected in respect of salaries of engineers.

W. P. Cheney, having recently been in Winnipeg, conveyed the greetings of the Winnipeg Branch and delivered an invitation from that Branch to attend the forthcoming annual meeting of the Engineering Institute of Canada, to be held in Winnipeg next February. Mr. Cheney then introduced the guest speaker, E. F. Holliday, Secretary, Educational Committee, Canadian Legion War Services, Inc.

Taking as the subject of his address **Education in the Services,** Mr. Holliday reminded his audience that the purpose of education is to discipline the mind rather than to fill it with information. The objective of the Legion is threefold:

1. To assist in building and sustaining morale;
2. To help make better fighting men;
3. To assist in the discharge and rehabilitation of the fighting forces.

All departments of education in Canada had assisted the Legion in devising a course of education that would be acceptable anywhere in Canada. Instruction may be by correspondence and the examination standings granted are accepted for credit in each province. The Committee also provides a library service of non-fiction and technical books. Over one thousand students are enrolled in Saskatchewan.

A hearty vote of thanks was tendered the speaker on motion of H. R. MacKenzie.

Mr. J. G. Schaeffer, convenor of the Committee on Collective Bargaining, reported the progress made to date. He advised that the recent legislation in Saskatchewan appeared to exclude Professional Engineers and that, to be covered, it was the opinion of his committee that special legislation would be necessary. For guidance in this direction the committee awaited information on a proposed order complementary to P.C. 1003 of the Dominion Government.

Following discussions on certain by-law amendments raising the Association annual fees, Messrs. W. B. Ramsay and C. W. Doody introduced a resolution, which carried unanimously, that:

"The executive take such action as may be necessary with the proper authorities to obtain income tax deductions on account of Association annual fees". In this connection it was noted that the members of the Ontario Teacher's Federation, according to the October 1944 Bulletin, had been granted tax deductions on account of annual fees.

SAULT STE. MARIE BRANCH

T. F. Rahilly, Jr.E.I.C. - *Secretary-Treasurer*

A general meeting of the Branch was held in the Windsor Hotel on May 26th 1944. The speaker was F. J. McDiarmid, mechanical engineer of the Algoma Steel Corporation Limited, who spoke on the stationary steam plant recently built by his company.

This plant consists of three Foster-Wheeler boilers each having a rating of 100,000 lb. of steam per hour at 400 p.s.i. when fired with blast furnace gas. Two of the boilers are equipped to fire pulverized coal. In addition to the usual auxiliaries, this plant has two turbo generators for supplying the electric power required by the plant and for reducing the steam pressure from 400 p.s.i. to 150 p.s.i. for general steel plant service. There is also a large water treating plant using both the hot process and Zeolite Systems for treating the feed water.

After a brief discussion of the equipment, construction and operation of the plant, the meeting adjourned and proceeded to the boiler plant for an inspection of its facilities.

Mr. McDiarmid had the assistance of Mr. G. A. Edwards, chief steam engineer of Algoma Steel, in conducting the visitors through the plant and in answering their many questions concerning its operation.

A general meeting was held in the Windsor Hotel on August 25th, 1944. Mr. A. E. K. Bunnell of the Department of Planning and Development of the Ontario Government, was the speaker his topic being **Post-War Planning** with emphasis placed on Civic Projects.

Mr. Bunnell stated that his department was formed for the purpose of co-ordinating the activities of various departments of the Ontario Government in the conservation of the natural resources of the province and of assisting in the rehabilitation of Ontario men to civil life. It also plans to assist municipalities in their relationships with the Ontario Government with regard to post war projects.

If there is a let-down after war, the higher levels of government working in conjunction with the municipalities must step in with construction. It was felt that plans must be prepared now to give assistance. This would promote sound rather than hasty planning.

City boundaries are artificial. Planning must go beyond the boundaries, city and township being a social entity.

In Sault Ste. Marie, the city owns most of the buildable property. Before disposing of this property, a plan should be made showing present uses of land and the location of lands which might be required for city use. A contour plan should also be made as a base for street, sewer and drainage studies.

Zoning of the city should be done. With zoning, housing loans may run for thirty years; without zoning, the loans run for twenty years.

Which streets are to be traffic arteries should be determined. Local and through traffic should not mix. The Trans-Canada highway passing through here would present a real problem. The best locale for a tunnel or bridge crossing the St. Mary's river should be studied for connections to roads to the north and east.

Post-war parking problems should now be faced. There will be more cars in the future than in the past. Certain streets should be widened so that traffic gravitates to them, every street being no longer a traffic street.

The Sault has a sewerage problem in storm and waste sewers. The more sprawl permitted a city, the worse the problem and the higher the cost. City property should not be sold in areas where there are no roads and sewers, while these facilities are available in other areas not yet built up. There are 4,000 to 5,000 parcels of land available in this city, sufficient for 16,000 people.

Alderman McQuarrie, chairman of the Post-War Planning Committee for Sault Ste. Marie, introduced the speaker. At the conclusion of the address the thanks of the meeting were conveyed to Mr. Bunnell by J. L. Lang and A. E. Pickering. A. M. Wilson, chairman, presided at the meeting.

Present at the meeting were representatives of the City Council, Lions Club, Rotary Club and the Board of Trade.

A general meeting of the Branch was held in the Windsor Hotel on Oct. 10th 1944, the occasion of the president's annual visit. Sixteen members were present.

Following the dinner, Chairman A. M. Wilson called on John Lang to introduce President de Gaspé Beaubien and General Secretary L. Austin Wright.

Mr. Beaubien addressed the meeting on **The Engineer's Place in Society.** K. G. Ross replied to the president's address.

The chairman then called upon Dr. L. Austin Wright, general secretary, who reviewed Institute business and gave an account of Headquarters custodianship of Institute affairs.

Attention of the meeting was drawn to the Annual Meeting at Winnipeg on Feb. 7th and 8th. It was stated that most of the papers would be on Western subjects, the suggestion being made that the Steep Rock Iron Mines and Ore Dock would make a good topic for papers.

The chairman conveyed the thanks of the meeting to Mr. Beaubien and Dr. Wright for their visit to the Branch.

Prior to the meeting, Mr. Beaubien and Dr. Wright spent part of the afternoon visiting the plant of the Algoma Steel Corporation Ltd., on the invitation of C. Stenbol, chief engineer.

TORONTO BRANCH

S. H. de Jong, M.E.I.C. - *Secretary-Treasurer*
G. L. White, Affil.E.I.C. - *Branch News Editor*

The Toronto Branch heard an interesting address on **Mechanization of Woodland Operations** at its meeting on November 16th at Hart House, University of Toronto. The speaker at this joint meeting with the Canadian Society of Forest Engineers was J. W. McNutt of Kimberly-Clark Corporation, Neenah, Wis.

The speaker made brief reference to mechanized operations on the Pacific Coast, the character of which is determined principally by the terrain and the size of timber to be handled. The principal cable systems used are (1) the ground snaking; (2) the high lead system; and (3) the aerial tram system.

The introduction of the track type tractor was probably the most important single step in mechanization of woodlands operation and came about 1904. The tractor permits selective logging where desired although it is more generally believed that the clean cut system is best.

Probably the most spectacular progress in mechanization, particularly in the application of power-driven saws, has taken place in the southern pine forests of the United States. The extensive mechanization in this area has been speeded by shortage of manpower, but is dependent in no small measure upon the relatively even ground for the conduct of operations. Other contributing factors are firm footing, little underbrush, relatively uniform weather, and the existence of networks of permanent roads throughout the area.

Woodlands operations may be divided into four main classifications: (1) Cutting; (2) Skidding; (3) Hauling; (4) Driving. Most pulpwood operations in Eastern Canada involve all four divisions. From the viewpoint of cutting pulpwood, difficulties are encountered in Eastern Canada in the application of the power saw because much of the best pulp timber is in swamp areas. Progress along this line may be made with the introduction of lighter saws which will aid greatly if they measure up to advance claims. Power saws are usually two-man equipments operated by gasoline engines, compressed air, or electricity. With compressed air or electricity one man is required for every two saws to keep the cable or hose clear. Saws are circular, chain or reciprocating with the chain seeming most likely to succeed.

Advances in skidding operations have been slow with hand work and teams are still largely employed in Eastern Canada. Considerable advances have been made in the mechanization of hauling, whether to water or the main haul to the mill. Trucks have made the big difference in hauling, with tractor hauling going out of vogue. Under driving, one must consider stream driving and towing. Principal advances in mechanization have been in the design of power boats for towing operations.

The speaker showed a very interesting film of mechanized operations in southern pine forests in the United States. This film illustrated the application of various types of power saws to felling and cutting up of trees and also the use of movable units for cutting up of lengths and hoisting them into trucks. This latter type of operation employs the power saws for felling and the tractors for hauling the trees to the cut-up and loading units.

Junior Section

A general meeting of the Junior Section was held in the Debates Room, Hart House, on Tuesday, December 4th. The speaker was Mr. C. H. Millard, president of the United Steel Workers of Canada, member of Executive of the Canadian Congress of Labour and C.C.F. Member of Provincial Parliament for West York, Ont., who spoke on **Labour's Post-War Outlook.** Mr. Millard quoted many prominent and informed persons who stated that in their opinion the cycle of prosperity, depression and war was an inherent component of our civilization. He stated that Labour will take definite steps in an attempt to alleviate this cycle and he outlined the twenty-nine point programme.

He stressed the fact that engineers, as a part of the group between management and labour, must ally themselves with either group and so get off the fence which he said is getting sharper and more uncomfortable all the time.

A lively discussion followed and although all sixty present did not see eye to eye with all Mr. Millard's statements they were very thought provoking and gave a clear picture of Labour's ideas.

VANCOUVER BRANCH

J. G. D'Aoust, M.E.I.C. - *Secretary-Treasurer*
P. B. Stroyan, M.E.I.C. - *Branch News Editor*

The annual dinner and business meeting of the Vancouver Branch was held in the Hotel Georgia on Saturday, November 18th. T. V. Berry, chairman, presided over the meeting which was attended by about 65 guests and members.

The business session of the meeting opened with the acceptance of the minutes of the last annual meeting and the presentation of the financial statements by Secretary P. B. Stroyan.

Chairman T. V. Berry then presented his report for the past year. A number of interesting meetings were held outstanding among which were the Ladies' Night at which C. E. Webb was speaker, and Student's Night conducted by members of the Student Chapter of the University of B.C. Three papers were read by students on this occasion.

An annual prize was established by W. N. Kelly for the student turning in the best machine shop examination project at the University of British Columbia. First winner of this prize was W. McFarlane Walker, fourth year Engineering student, who was among the guests present and who was introduced to the members by Mr. Kelly.

The slate of officers for the following year was presented by the nominating committee and elected by acclamation. Election of a nominating committee for the following year completed the business of the evening.

Lieutenant Black, R.C.N.V.R., guest speaker of the evening then addressed the members giving them a very colourful and witty description of his experiences during service with the Royal Navy on convoy duty in the Mediterranean area. The various types of vessels on which he sailed were described and Lieutenant Black related many humourous incidents of his term in the service. The speaker was thanked on behalf of the members by Col. W. G. Swan.

A few words by the chairman elect, Professor A. Peebles of the Dept. of Civil Engineering, University of B.C. concluded a most enjoyable evening.

WINNIPEG BRANCH

T. E. Storey, M.E.I.C. - *Secretary-Treasurer*
V. W. Dick, M.E.I.C. - *Branch News Editor*

At an evening meeting at the University of Manitoba on Broadway, on November 2nd, a coloured sound film on plastics **The Formica Story** was shown. The manufacture and varied uses of laminated plastics was illustrated, and the method of manufacture for whatever purpose they are intended to be put was shown. Their lightness, hardness, adaptability to a wide range of uses, and their possibilities for decorative furniture or interior furnishings and other attributes were well illustrated. A large number turned out to take advantage of this interesting film.

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Town Planning was the subject of an address at the joint general meeting of the Winnipeg Branch of the Institute and the Manitoba Association of Professional Engineers, held at the University of Manitoba, Broadway, on December 7th, under the chairmanship of C. P. Haltalin, branch vice-chairman.

F. S. Adamson, assistant city engineer, introduced the speaker, Lawrence J. Green, B.Sc.Arch. M.R.A.I.C., who advised that not only engineers and architects, but also sociologists, economists, and others have contributed to town planning knowledge.

Mr. Green traced the planning of towns from the medieval type behind its protecting walls and the colonial type around its "common", to the modern version of "main street" built around the cross-road on the through highway.

The necessity of planning was brought out by an examination of a central district in the city, a "blighted" area due to many non-conforming uses of the property in its area.

It was pointed out that "blight" was the greatest single factor in the high cost of housing. It destroys property values by rendering buildings and whole districts undesirable, while the buildings and services are yet structurally capable of fulfilling the uses for which they were intended.

The high cost of blighted districts was presented in figures quoted from City Health Department reports, resulting from adult crime, juvenile delinquency, disease and death. City planning shows how to control and eliminate blight, and to stabilize property values and the tax roll.

Planning is essential for the welfare and well ordered growth of any modern city, as it provides a framework on which to build. The cost of such planning will be more than paid for by the saving in property values, which would otherwise be destroyed by the spread of blight.

Mr. Green then outlined the needs of a modern city in regard to traffic, airfields, protected neighbourhoods, business districts, parks and the other vital necessities of a well planned community. He pointed out that Winnipeg was fortunate in having a Metropolitan Town Planning Committee and a City of Winnipeg Town Planning Commission, both working together under a joint executive committee, with a Town Planning Consultant. Personnel was being gathered for the planning office, and the necessary data was now being gathered for the commencement of a city plan, which will make for better living and working conditions and a more beautiful community for the citizens of Winnipeg.

Considerable discussion followed, those taking part being: C. V. Antenbring, Prof. G. H. Herriot, R. H. Avent, W. D. Hurst, and others.

The discussion period was closed by C. V. Antenbring who moved a vote of thanks to the speaker.

Library Notes

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

BOOK REVIEW

THE ROMANCE OF MINING

by T. A. Rickard. The Macmillan Co. of Canada Ltd., Toronto, 1944. 450 pp.

Reviewed by G. W. WADDINGTON, M.E.I.C.

Here is a story of mining that will be enjoyed by people in all walks of life. It deals with ordinary people, yet the incidents are far removed from everyday life. They have the charm of the unexpected; they incite our wonder; they appeal to our imagination. With the prospector, we share a series of strange and unusual experiences as we are drawn ever onward toward the pot of gold at the foot of the rainbow. Here is true romance—the antithesis of commonplace.

As a contribution to the history of mining, this book also has considerable merit, especially when we reflect that accuracy in such matters is not easy to attain. The discoverers of mines and those connected with their early development are not always careful in their statements. After the lapse of a few years the essential facts become clouded with fabrications amid which the truth is hard to find. The discoverer of an ore deposit that becomes famous as a mine usually will endeavour to ignore the accidental elements in his good fortune, and impute his success to quasi-scientific knowledge such as will serve to glorify his sagacity. A picturesque yarn is preferred to a vivid statement of fact. In this work Dr. Rickard has sorted out the true from the fictitious, and has provided us with an authentic account that is stranger than fiction.

The prospector, who is the forerunner or advance guard of the industrial army of mining, is mentioned in the records of the expeditions sent by the Pharaohs from Egypt to the peninsula of Sinai. In this arid region overlooking the Red Sea there have been found memorial stones bearing engraved records of mining expeditions sent there about 3,000 B.C. A later inscription records the tribulations of a certain prospector named Harurre, about 1830 B.C.: "The desert was hot as a furnace, the hilltop seemed on fire, and the vein of ore was exhausted". Down through the ages, how many prospectors and mining engineers have found themselves in a similar predicament!

The first mining adventure of which we have any written record is that of Jason and his comrades, who sailed from Greece to the gold diggings in Colchis (now Georgia) on the southwestern slope of the Caucasus where this range of mountains approaches the waters of the Black Sea. Their ship was the Argo, due to which the adventurers have become known as the Argonauts. The Golden Fleece was a sheep's fleece, used to recover fine particles of gold from river sand.

The latter half of the nineteenth century was marked by an intensive and successful search for minerals, the immediate consequence of which was to incite a world-wide migration of enterprising men, an enormous expansion of international trade, and the spread of scientific industry to the waste places of the earth. The event that started these movements was the discovery of gold in California in January, 1848. At that time California belonged to Mexico. On February 2 of the same year the United States annexed California, New Mexico, Arizona, Nevada, Utah and portions of Colorado and Wyoming, paying only $15,000,000. for this enormous territory. Gold equivalent to three times the amount of this payment was produced in California in 1849, the year following the signing of the treaty. Within two years of the discovery 100,000 men had arrived in California from the eastern part of the United States. Gold was discovered in Australia in 1851. Within a year of the discovery 369,000 emigrants from Great Britain had arrived in Australia.

Other interesting episodes in this entertaining book include the Silver of Laurium, Frobisher's Quest, the adventures of Cortés and Pizarro in the sixteenth century, the story of the diamonds of Kimberley, the mineral development in the western United States, and the gold discoveries in Witwatersrand, the Yukon territory and New Guinea. Into these chapters are interwoven the careers of many notable men whose names are familiar to everyone.

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS

Occupational Accident Prevention:

Harry H. Judson and James M. Brown. N.Y., John Wiley and Sons, 1944. 5½ x 8½ in. $2.75.

Flexible Shaft Handbook:

2nd edition. N.Y., The S. S. White Dental Mfg. Co., Industrial Division, 1944. 5½ x 8½ in.

Science in a Tavern:

Essays and diversions on science in the making. Charles S. Slichter. The University of Wisconsin Press, Madison, Wis., c. 1940. 5¾ x 8¾ in.

American Men of Science:

A biographical directory. 7th edition. The Science Press, Pa., 1944.

Metallurgical Experiments:

(Non-ferrous metals, iron and steel). F. Johnson. London, Paul Elek (Publishers) Ltd., 1944. 5¼ x 8¼ in. 5 sh.

The A B C of Physics:

Jerome S. Meyer. Toronto, Longmans Green and Co., 1944. 5½ x 8 in. $4.50 (Canadian price).

Canadian Standards Association:

Z92-1943: Recommended practice of industrial lighting. Z90-1943: Part 1 and 2, Guide for quality control and control chart method of analyzing data. American War Standard, approved May 1941 by the American Standards Association and adopted as a CESA standard March 16th, 1943. Part 3, Control chart method of controlling quality during production. American War Standard, approved April 1942 by the American Standards Association and adopted as a CESA standard March 16th, 1943.

TRANSACTIONS, PROCEEDING

North East Coast Institution of Engineers and Shipbuilders:

Transactions vol. 60, 1943-1944. Newcastle Upon Tyne, 1944.

The Society of Naval Architects and Marine Engineers:

Transactions vol. 51, 1943. N.Y., The Society, 1944.

REPORTS

Queen's University—Dept. of Industrial Relations:

Bulletin no. 9: The closed shop—a study of the methods used by unions to attain security. October, 1944.

U.S.—War Manpower Commission:

Informational manual on industrial job evaluation systems. Washington, Government Printing Office, 1943.

Carnegie Corporation of New York:

Annual report for the year ended September 30, 1944.

National Research Council of Canada:

Twenty-sixth annual report for the year 1942-1943.

Canada—Dept. of Labour:

Thirty-third annual report on labour organization in Canada. Ottawa, King's printer, 1944.

Toronto Harbour Commissioners:

Annual report for the year 1943.

U.S.—National Research Council—Highway Research Board:

Wartime Road Problems No. 9: Recommended practice for treatment of icy pavements.

Ontario—Dept. of Mines:

Fiftieth annual report being vol. 50, part 6, 1941.

American Institute of Mining and Metallurgical Engineers—Technical Publication:

No. 1543: Replacement hematite deposits, Steep Rock Lake, Ontario by Hugh M. Roberts and M. W. Bartley.

U.S.—Bureau of Mines—Technical Paper:

No. 659: Analyses of Pennsylvania anthracite coals.—No. 663: The flow of coal-ash slag on furnace walls.—No. 666: Bureau of mines research on the hydrogenation and liquefaction of coal and lignite.

U.S.—Bureau of Mines—Miners' Circular:

No. 45: Explanation and justification of tentative inspection standards for bituminous-coal mines and lignite mines.

U.S.—Bureau of Standards—Building Materials and Structures Report:

BMS102: Painting steel.

The Electrochemical Society—Preprints:

No. 86-24: Continuous concentration of electrolytic caustic soda.—No. 86-23: Mineralogy of the manganese exices.—No. 86-25 Silver alloy brazing with induction heating.—No. 86-24: The fabrication of magnesium alloys.—No. 86-27: Induction heating in radio tube manufacture.—No. 86-28: Film in chromium electroplate.—No. 86-29: X-ray and electron microscope evaluation of carbon blacks.

BOOK NOTES

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.

AIRPORT ENGINEERING

By H. O. Sharp, G. R. Shaw and J. A. Dunlop. John Wiley & Sons, New York; Chapman & Hall, London, 1944. 150 pp., illus., diagrs., charts, tables, 11¼ x 8½ in, cloth, $5.00.

This undergraduate textbook presents concisely the problems that confront the airport builder. After a brief discussion of airport size and site, planning and preliminary surveys are considered. Problems of grading, drainage, soil stabilization, and paving are then treated. Finally, lighting, buildings, and construction and maintenance equipment are presented.

AMATEUR TELESCOPE MAKING

Edited by A. G. Ingalls and others. 497 pp., $4.00.

AMATEUR TELESCOPE MAKING ADVANCED, a sequel to "Amateur Telescope Making,"

Edited by A. G. Ingalls. 650 pp., $5.00.
Munn and Co., New York, 1943-1944. illus., diagrs., charts, tables, 8 x 5¾ in., cloth.

A comprehensive, detailed account of the parts and operations necessary for the construction of telescopes is presented in this two-volume set. Volume I discusses types, lenses, mirrors, mountings, drives, etc., and provides some 200 pages of practical information on a large number of technical details. Volume II offers a more advanced description of the finer work needed to produce superior instruments, and also covers the practical aspects of observing. There is a twenty-page annotated bibliography in the first volume.

(The) ASHLEY BOOK OF KNOTS (Mariners Museum Publication No. 13)

By C. W. Ashley. Doubleday, Doran & Co., Garden City, New York, 1944. 620 pp., illus., diagrs., 11½ x 8¼ in., cloth, $7.50.

This comprehensive work is encyclopedic in character. Not only is a tremendous variety of knots described and illustrated but general and specific historical information is also included, and exact procedures for the tying or forming process are given in many cases where a diagram is insufficient. Sailors' knots predominate, but many other occupations are covered, as well as fancy knots and braiding, tricks and puzzles. Technical distinctions among the various classes of knots, hitches, bends, splices, etc., are carefully explained, and a bibliography and glossary are appended.

BULLDOZERS COME FIRST, the story of U.S. War Construction in Foreign Lands

By W. G. Bowman, H. W. Richardson, N. A. Bowers, E. J. Cleary and A. N. Carter, McGraw-Hill Book Co., New York and London, 1944. 278 pp., illus., maps, 9 x 5¾ in., cloth, $2.75.

An interesting series of articles describing the work of American engineers overseas during the present war, as seen by war-correspondent editors of the Engineering News-Record, in which the articles first appeared. Great Britain, North Africa, the Middle East, Alaska, the Aleutians, the Pacific ocean areas, South America and Central America were visited.

COMFORTIZATION OF AIRCRAFT

By A. A. Arnhym. Pitman Publishing Corp., New York and Chicago, 1944. 347 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $7.50.

Looking to the future, designers and others associated with the airplane industry and air transport are concerned with passenger comfort and conveyance. The author has assembled technical data, calculations, information and illustrations useful in eliminating discomforts inherent to flying. He outlines the various important phases, and gives a detailed analysis of air supply, heat supply, soundproofing, seating, berthing, catering, etc. Procedures and methods are included for incorporating, specifying, selecting and servicing comfort equipment.

CUMULATIVE INDEX for Volumes I, II, III, IV, V and VI of The CHEMICAL FORMULARY

By H. Bennett. Chemical Publishing Co., Brooklyn, N.Y., 1944. 164 pp., 8¾ x 5½ in., cloth, $4.00.

Owners of the Chemical Formulary will welcome this index, which covers all the formulas and recipes included in the six volumes of that work. The index is alphabetic, with cross-references.

(The) DYNAMICS OF TIME STUDY

By R. Presgrave. University of Toronto Press, distributed by Ambassador Books Ltd., 12 Richmond St. East, Toronto 1, Canada, 1944. 211 pp., diagrs., tables, 9¼ x 6 in., cloth, $3.50.

The author analyzes the essential principles to which sound time study technique must conform in order to function effectively. He points out many elements which are unnecessary or are actual drawbacks in time study work. The primary design of the book is to help those now engaged in time study to assess their present methods, to modify them out of reason rather than out of experience and so to use them with greater confidence.

GENERAL METEOROLOGY, published formerly under the title, "Synoptic and Aeronautical Meteorology"

By H. R. Byers. McGraw-Hill Book Co., New York and London, 1944. 645 pp., illus., diagrs., charts, maps, tables, 9 x 5½ in., cloth, $5.00.

This book is designed as a general text embodying the fundamentals as well as the modern development in synoptic meteorology, including recent advances in the field such as: isentropic analysis, new forecasting uses of upper-air pressure charts, etc. The last five chapters of the book cover material of particular importance in aeronautics. An appendix contains practical aids for the student and meteorologist.

MANUAL OF MACHINE SHOP PRACTICE

By O. Benedict, Jr. McGraw-Hill Book Co., New York and London, 1944. 249 pp., illus., diagrs., charts, tables, 7½ x 4¾ in., fabrikoid, $1.75.

The main part of this small book is devoted to such aspects of machine shop practice as cutting speeds and times, screw thread production, the spiral head for milling machines, tolerances and allowances, precision measuring devices, press tools and machine tool analysis. Ten illustrative experiments for various operations are included, and a considerable amount of technical data is provided in an appendix.

NOTES ON HELICOPTER DESIGN THEORY

By A. A. Nikolsky. Princeton University Press, Princeton, N.J., 1944. 228 pp., diagrs., charts, tables, 9 x 6 in., paper, $3.00.

This volume presents a series of lectures given at Princeton University in the spring of 1944 to a group of engineers representing the Army and Navy air forces and various aircraft manufacturers. The treatment is theoretical and mathematical and, of necessity, tentative, as theory in this field is still in an unstable state.

PADDLE-WHEEL DAYS IN CALIFORNIA

By J. MacMullen. Stanford University Press, Stanford University, Calif., 1944. 157 pp., illus., woodcuts, tables, 10¼ x 7 in., cloth, $3.00.

The first steamboat came to California in 1847. For the next ninety years steamboats were an important part of the transportation system of the state. The story of the rise and fall of steamboating is told, with many anecdotes and pictures of famous boats.

PAPER AND PAPERBOARD

Characteristics, Nomenclature, and Significance of Tests. October, 1944, sponsored by A.S.T.M. Committee D-6 on Paper and Paper Products, American Society for Testing Materials, 260 So. Broad St., Philadelphia, 1944. 108 pp., illus., charts, tables, 9 x 6 in., paper, $1.50.

The four parts of this report cover respectively: general considerations and the nature of paper properties; the action of water on paper and its significance; definition of terms, nomenclature, and properties of various classes of paper and paperboard; and a discussion of commonly used tests applied to paper and paperboards and their significance. A complete list of A.S.T.M. and TAPPI test methods is included.

PLASTICS STOCK MOLDS

Catalog of Stock Molded Parts, Extrusions and Laminates; compiled by Stock Mold Department of MODERN PLASTICS Magazine, 122 East 42nd St., New York, 1944. 168 pp., illus., 10 x 8 in., cardboard spiral binding, $5.00.

Nearly 1,600 current stock injection and compression molds for plastics are illustrated in this Catalog, classified under twenty-two headings according to type of product. By reference to a list of item numbers the company owning any mold may be found. This revised edition also provides the same service for some 200 standardized extruded cross-sections and laminated sheets, rods and tubes.

PROCEDURES FOR TESTING SOILS, Nomenclature and Definitions, Standard Methods, Suggested Methods, September 1944

American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. 200 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $2.25.

This publication brings together in convenient form various methods of testing soils now in current use. In addition to thirteen methods already adopted by the Society there are also 38 suggested methods representing test procedures, comment and criticism on which are invited. The test procedures fall into five categories; indicator tests; compaction and consolidation tests; strength tests; tests for soil-cement; and tests for soil-bituminous mixtures.

STEAMBOATS COME TRUE, American Inventors in Action

By J. T. Flexner. The Viking Press, New York, 1944. 406 pp., illus., diagrs., 8½ x 5½ in., cloth, $3.50.

An interesting, well written account of the early history of the steamboat. The stories of Fitch, Fulton and Rumsey are told. Fitch's life is described with some fullness, and the reasons for his failure explained. Fulton is given credit as the "inventor," the man who finally won the race. There is a good bibliography.

TERNARY SYSTEMS, Introduction to the Theory of Three Component Systems

By G. Masing, translated by B. A. Rogers. Reinhold Publishing Corp., New York, 1944. 173 pp., diagrs., tables ,9¼ x 6 in., cloth, $4.50.

This translation from the German presents a thorough exposition of the fundamental theory underlying ternary systems. Special care has been taken with reference to the difficulties which the beginner meets, and only the simpler structural cases have been described. The methods used for investigating such systems receive little attention as they are so similar to those used for binary systems. Some of the more important industrial alloys have been particularly discussed in the last three chapters.

(The) UNIVERSE AROUND US

By Sir J. Jeans. 4th ed. rev. and reset. University Press, Cambridge, England; Macmillan Co., New York, 1944. 297 pp., illus., diagrs., charts, table, 8½ x 5½ in., cloth, $3.75.

This book contains a brief account, written in simple language, of the methods and results of modern astronomical research, both observational and theoretical. Special attention has been given to problems of cosmogony and evolution and to the general structure of the universe. This fourth edition has been largely rewritten in the light of recent advances, such as the application of the physics of atomic nuclei to various stellar phenomena.

YOUR SERVANT THE MOLECULE

By W. S. Landis. The Macmillan Co., New York, 1944. 239 pp., illus., diagrs., tables, 8½ x 5½ in., cloth, $2.75.

The majority of the chapters in this book for the layman deal with the chemical background of everyday necessities such as food, shelter, clothing, soaps, drugs, petroleum products, etc. Other chapters discuss in simple language organic chemistry, colloids, chemical research, and the history and nomenclature of the chemical art.

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

December 27, 1944.

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 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

BARKER—FREDERICK GEORGE, of Arvida, Que. Born at Montreal, Que., Nov. 6th, 1917. Educ.: B.Eng. (Chem.Eng.), McGill Univ., 1939; 1939-40, Shell Oil Co. of Canada, Ltd.; 1940 to date, with the Aluminum Co. of Canada, Ltd., & at present, fluoride plant supervisor i/c aluminum fluoride & cryolite production, Arvida, Que.

References: A. C. Johnston, P. E. Radley, E. Brown, D. D. Reeve, B. E. Bauman.

BARRATT—PHILIP S., of 204 Kootenay Ave., Tadanac, B.C. Born at Marlowe Green, England, April 18th, 1907. Educ.: B.A.Sc. (Civil), Univ. of B.C., 1932; 1929 (summer), engrg. dept., City of Vancouver; 1930 (summer), P.G.E. Resources Survey; 1932-33, drfsman. & later surveyor, Pioneer Gold Mines, Ltd., Bridge River; 1933-35, asst., Langley & Warren, Vancouver, also (5 mos.) i/c survey for hydro-elec. power plant & installn. of dam & pipe line 3 miles long at Hedley, B.C. under supervsn. of W. R. Bonnycastle, M.E.I.C., 1935-40, mine surveyor & later asst. mine engr., Kelowna Exploration Co. Ltd.; 1940 (8 mos.) preparation of plans for pulp mill at Port Alberni, Bloedel, Stewart & Welch Co. Ltd.; 1940 to date, engrg. drfsman., constrn. dept., Consolidated Mining & Smelting Co. of Canada Ltd., Trail, B.C.

References: S. C. Montgomery, G. H. Bancroft, A. C. Ridgers, C. E. Marlatt, T. W. Lazenby.

COTE—J. F. RAOUL, of Montreal, Que. Born at Pointe aux Outardes, Que., Sept. 7th, 1907. Educ.: 1928-34, surveying, mapping & civil engrg., I.C.S.; With the Ontario Paper Co. Ltd., as follows: 1925-29, chainman, levelman & instru'man., 1929-32, asst. chief engr., Outardes Falls, 1932-33, forestry engrg., Shelter Bay, Que.; 1935-37, field engr., 1938-39, surveying; 1939-40, field engr., constrn., Foundation Co. of Canada; 1940-41, field engr., Ontario Paper Co Ltd.; 1941, surveying, C.P.R.; 1941-43, field engr., dredging, etc., Beauharnois Light, Heat & Power Co.; 1943 to date, inspr., aircraft layout & tooling engrg., Canadian Car & Foundry Co. Ltd., Montreal. (Asks for admission as an affiliate).

References: C. G. Kingsmill, B. K. Boulton, P. G. Gauthier, A. Babin, L. C. Nesham, R. Lord.

CUNNINGHAM—JOHN, of Vancouver, B.C. Born at Uddingston, Scotland, Oct. 3rd, 1889. Educ.: 1908-11, Glasgow & West of Scotland Tech.Coll.; 1905-10, ap'tice civil engr. & 1910-11, junior asst. engr., district engr., County of Lanark, Scotland; 1911-14, asst. res. engr., water & sewerage scheme & later res. engr., Manaos, Brazil; 1914, engr., Sao Paulo Land Co. Ltd., town planning & land development; 1914-19, army service, Royal Engrs.; 1919-24, engr., Sao Paulo Land Co. Ltd., Santos, Brazil; 1927-44, field engr., various undertakings & from 1937, supt., i/c large defence projects, Northern Construction Co. & J. W. Stewart Ltd.; At present, mgr., North Western Dredging Co. Ltd., Vancouver, B.C.

References: N. D. Lambert, W. Smaill, P. B. Stroyan, W. L. Kent, J. B. Barclay.

DUPUIS—JOHN JOSEPH, of St. Anselme, N.B. Born at Truro, N. S, Sept. 26th, 1912. Educ.: 1944, Nova Scotia Tech. Coll.; 1930-35, elec. ap'tice., J. F. Boudreau, Moncton; 1935-36, elec. constrn., Canadian Comstock Co. Ltd.; 1936-41, mtce. & elec. foreman, International Nickel Co.; 1941 to date, Royal Cdn. Navy, and at present, Elect. Sub.-Lieut., R.C.N.V.R.

References: F. H. Sexton, G. H. Burchill, W. H. G. Roger, J. J. Smith, J Deane.

GUSSOW—WILLIAM CARRUTHERS, of Arvida, Que. Born at London; England, April 25th, 1908. Educ.: B.Sc. & M.Sc., Queen's Univ., 1933 & 1935, Ph.D., M.I.T., 1937; 1927-29, map dftsman., geological survey; 1930-32 (summers) student asst., geological survey field party, Sudbury & Northwest Territories; 1933 (summer), senior drfsman., survey party, Port Arthur; 1934, geologist, Robb-Montbray Mine, Que.; 1935, senior asst., Ont. Bureau of Mines, Sturgeon River Area; 1936-37, Royal Society of Canada Research Fellowship; 1938-39, geologist, R.M.C. Staff; 1939, geologist, i/c field party, Ont. Bureau of Mines, Lake Nipigon; 1940, mech. dftsman., Mechanization & Artillery Branch, Dept. National Defence, Ottawa; 1940-41, chief cost engr., & 1941-43, chief quantity engr. & office engr., Foundation Co. of Canada, at St. Paul l'Ermite & Shipshaw, Que.; 1944, office engr., i/c equipm't. disposal, & at present, res. engr. on construction, Arvida Works, Aluminum Co. of Canada, Ltd.

References: C. Miller, W. F. Campbell, W. Griesbach, R. A. H. Hayes, R. F. Legget, A. C. Johnston, R. E. Jamieson, H. V. Serson.

HANSEN—HAROLD EDWARD, of Calgary, Alta. Born at Yorkton, Sask., July 3rd, 1914. Educ.: B.Sc. (Chem. Eng.), Univ. of Sask., 1937; With the British American Oil Co. Ltd. as follows: 1936-39, lab. asst., petroleum refinery, Moose Jaw, Sask., 1939-41, asst. chemist, 1941-43, chief chemist, 1943-44, process engr., and at present asst. supt., Calgary, Alta.

References: D. G. Tapley, J. Haddin. E. Avery, J. J. Hanna, F. C. Tempest.

HARRISON—VICTOR FRANK, of 171 Cameron Ave., Ottawa, Ont. Born at London, England, Sept. 6th, 1918. Educ.: B.Sc. (Chem. Eng.), Queen's Univ., 1943; 1937-39, asst., rubber lab., National Research Council, Ottawa; 1940-41 (summers), lab. technician, chemical warfare, Dept. National Defence, Ottawa; 1942 (summer), lab. asst., magnesium investigation, Dept. of Mines & Resources; 1943-44, junior chemist, Imperial Oil, Ltd., Sarnia, Ont.; At present, Private, R.C.A.M.C., Cdn. Active Army.

References: D. S. Ellis, L. Trudel.

HOBBS—DAVID HAYDN, of 922 Moissan St., Arvida, Que. Born at Cleveland, Ohio, Mar. 17th, 1917. Educ.: B.Eng. (Chem.), McGill Univ., 1939; 1936 (summer), lab. work, G. H. Mumm & Co., Reims, France; 1937 (summer), paint lab., Thorp-Hambrock Co.; 1939 to date, with the Aluminum Co. of Canada & subsidiaries in various departments, & at present engaged on a special assignment dealing with misc. production problems under the production supt., Arvida, Que.

References: T. H. Henry, P. H. Morgan, R. W. Emery, R. W. Johnson, B. E. Bauman.

HONEYWELL—WILLIAM ROBERT, of 142 Dover St., Arvida, Que. Born at Ottawa, Ont., Jan. 19th, 1916. Educ.: B.Sc. (Mining Eng.), Queen's Univ., 1940; 1941-42, stope & development engr., Preston East Dome Gold Mines, South Porcupine, Ont.; 1942-43, tech. asst., & 1943 to date, asst. supervisor, fluoride plant, Aluminum Co. of Canada, Arvida, Que.

References: P. E. Radley, A. T. Cairncross, D. D. Reeve, H. R. Fee.

HUNTER—HOWARD HURON, L/Cpl., R.C.E., Canadian Army Overseas. Born at Mimico, Ont., Oct. 22nd, 1909. 1933-34, Colorado School of Mines, Golden, Colorado; I.C.S. course in mining engrg. & surveying; With the Canadian Genl. Elec. Co. Ltd., as follows: 1929-32, testing dept., & on completion of testing course in 1930, pro moted to main tester on A.C. & D.C. equipm't.; 1934-36, student course at Consolidated Main Reef & Estates, Maraisburg, Transvaal, S.A., & later underground mach. & blasting foreman; 1936-37 field man & mining property mgr., Spirit Lake holding, Patricia, Ont.; Anglo-Huronian Corp., Toronto; 1937-39, chief engr., Perron Gold Mines, Perron, Que.; At present, surveyor, Class "A", No. 1 Cdn. Field Sqdn., R.C.E., C.M.F.

References: A. R. Jones, R. M. Prendergast.

JUNKIN—BRUCE FREDERICK, Elect. Lieut., R.C.N.V.R., of Halifax, N.S. Born at Winnipeg, Man., Jan. 21st, 1920. Educ.: B.Sc. (Elec.), Univ. of Man., 1943; 1943 to date, with the R.C.N.V.R., and at present instructor in various applications of D.C. for all elec. personnel, H.M.C. Torpedo School, Halifax, N.S.

References: J. Deane, E. P. Fetherstonhaugh, N. M. Hall, C. K. Hurst, M. A. P. Harrigan.

KING—JAMES MALCOLM, of 277 Monaghan Road, Peterborough, Ont. Born at Toronto, Ont., April 17th, 1917. Educ.: B.A.Sc., Univ. of Toronto, 1940; 1937-38 (summers), metallurgical control work & research asst. in smelters of Falconbridge Nickel Mines & Consolidated Mining & Smelting Co., Trail, B.C.; 1939 (summer), research asst., Ontario Research Foundation Toronto; 1940-41, metallurgist, i/c operations & metallic materials, Canadian Genl. Elec. Co., Peterborough; 1941-43, chief metallurgist, Genelco Ltd.; At present, metallurgist, Canadian Genl. Elec. Co., Peterborough, Ont.

References: J. Cameron, D. V. Canning, H. R. Sills, A. R. Jones, D. J. Emery, V. S. Foster, B. Ottewell, W. T. Fanjoy, A. L. Malby.

LAMBERT—LORNE C. of Arvida, Que. Born at Copper Cliff, Ont., June 16th, 1912. Educ.: B.Sc. (Mech.), Queen's Univ., 1936; 1935 (summer), genl. mach. shop practice, & 1937-42, dust control problems, instrument applications, etc., International Nickel Co., Port Colborne, Ont.; 1942-43, supt., Port Colborne Forgings Ltd.; 1943-44, asst. plant engr., Etobicoke Works, & 1944 to date, dust control engr., Aluminum Co. of Canada, Arvida, Que.

References: A. C. Harvie, D. D. Reeve, G. A. Antenbring.

LEWIS—RONALD WILFRED JAMES, of Arvida, Que. Born at Riga, Russia, Oct. 15th, 1913. Educ.: B.A.Sc., Univ. of Toronto, 1938; 1940-42, mgr., L. J. McGuinness & Co. Ltd., Mimico, Ont.; 1942 to date, asst. supervisor, ore plant, Aluminum Co. of Canada, Arvida, Que.

References: J. T. Nichols, R. W. Johnson, P. M. deChazal, G. A. Antenbring.

MacNEIL—REGINALD J., of Arvida, Que. Born at Halifax, N.S., March 12th, 1913. Educ.: B.Eng. (Mining), Nova Scotia Tech. Coll., 1937; 1936 (summer), Montag ue Gold Mines, Dartmouth, N.S.; 1937-38, shift operator, O'Brien Gold Mines, Kewagama, Que., flotation & later cyaniding roasted concentrates; 1938-41, assayer, & 1941-42, asst. mine engr., Clive Lake Gold Mines, Ltd., Lochalsh, Ont.; 1942 to date, supervisor of calcination, ore plant No. 2, Aluminum Co. of Canada, Arvida, Que.

References: A. T. Cairncross, G. A. Antenbring, J. T. Nichols, P. de Chazal, D. D. Reeve.

MARLATT—CHARLES DOUGLAS, Elec. Sub.-Lieut., R.C.N.V.R., of Vancouver, B.C. Born at Brandon, Man., July 28th, 1920; Educ.: 1944, Nova Scotia Tech. Coll.; 1940-41, radio technician, Canadian Genl. Elec. Co., Vancouver, B.C.; 1941-44, Elect. Artificer, Royal Canadian Navy, and at present, Elect. Sub-Lieut., R.C.N.V.R., Vancouver, B.C.

References: F. H. Sexton, J. J. Smith, J. Deane, M. A. P. Harrigan.

MASON—GEORGE MEREDITH, of 101 Castner St., Arvida, Que. Born at Toronto, Ont., March 5th, 1908. Educ.: B.A.Sc., Univ. of Toronto, 1930; 1928-29, (summers), instru'man., Dept. of Works, City of Toronto; 1930-39, member plant research dept., Shawinigan Chemicals Ltd., Shawinigan Falls, Que.; With the Aluminum Co. of Canada, Ltd., as follows; 1939-42, supervisor of control & development, 1942-43, asst. supt., & 1943 to date, technical director, Arvida, Que.

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MILLAR—ALFRED EDWARD, of Quebec, Que. Born at Quebec, Que., July 21st, 1917. Educ.: Certified Technician in Drafting & Machine Shop, Quebec Technical School, 1939; 1939-40, toolmaker & machinist, Dept. of Arms and Ammunition, Quebec; 1940-41, Armament Artificer, R.C.A.F., Trenton & Ottawa, Ont.; 1941-43, instructor, mach. shop & technology, Quebec Technical School; 1943-44, dftsman. & instructor, blueprint reading & technology, Anglo Shipbuilding Co., Louise Basin, Quebec; At present, dftsman., F. B. Leggett Engineering Co., Quebec, Que.

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MULDER—FRITHO RUDGER ERICK, of Norman Wells, Northwest Territories. Born at Isle of Java, Dutch East Indies, Jan. 13th, 1918. Educ.: 1936-38, Univ. of B.C.; Certified Assayer & Analyst, Province of B.C.; 1938-40, genl. lab. & assay work including umpire analysis, constrn. & industrial testing & inspn. work, concrete & steel, also 3 mos. i/c assay office, Spud Valley Gold Mines, Ltd., Zeballos, B.C.; 1940-43, lab. asst., Royalite Oil Co., Turner Valley, Alta.; 1943 to date, petroleum engr., i/c lab. & engrg. work, Imperial Oil Ltd., Norman Wells, Northwest Territories.

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SEGALOWITZ—KAIMAN, of Fort William, Ont. Born at Ottawa, Ont., Mar. 6, 1919. Educ.: B.C.E., College of the City of New York, 1939; R.P.E. Que.; 1940-41, D.I.L., St. Paul l'Ermite, Que.; 1941-43, Foundation Co. of Canada, Shipshaw, Que.; 1943 to date, asst. supervisor, project staff, engrg. dept., Canadian Car & Foundry Co., Fort William, Ont.

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STACEY—LEONARD BROWN, of 570 Dunsmuir St., Vancouver, B.C; Born at Kenora, Ont., April 7, 1900. Educ.: B.A.Sc. (E.E.), Univ. of B.C., 1924. R.P.E., B.C.; 1922 (summer), Sumas pumps, Dominion Engrg. Works; 1923 (summer) Cottrell Plant, Consolidated Mining & Smelting Co.; 1925-26, design of industrial motors, Cnd. Westinghouse Co.; 1926-27, elec. inspr., Boiler Inspn. & Insurance Co., Toronto, Ont.; 1927-29, asst. prof. of elec. engrg., Univ. of B.C.; 1929 to date, dist. mgr., Packard Elec. Co. Ltd.

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STILES—EDWIN MILO, of Trail, B.C. Born at Midnapore, India, July 18th, 1891; Educ.: B.Sc., Dartmouth College, N.H., C. E., Thayer School of Engineering, 1912 & 1914; R.P.E., B.C.; R.P.E., Alta.; 1914-17, U.S. Reclamation Service; 1915-16, Anaconda Copper Mining Co.; 1916-17, structl. designer, Nevada Consolidated Copper Co.; 1917 to date, with the Consolidated Mining & Smelting Co. as follows: 1918-23, chief drfsman., 1923 to date, chief engr., i/c of all constrn. work for the company anywhere, 1940-42, on loan as cheif engr., Alberta Nitrogen Co., on constrn. of ammonia plant for Dept. of Munitions & Supply, Calgary; 1942-44, part time as pres., Kootenay Engineering Co., i/c constrn. hydro elec. project, Brilliant, B.C.

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TRUEMAN—JAMES COBDEN, of Winnipeg, Man. Born at Chatham, England, Nov. 28th, 1900. Educ.: B.Sc. & M.Sc., McGill Univ., 1923 & 1924. R.P.E. Man.; 1917-27, instru'man. & dftsman., rly. constrn., mtce., American Bridge Co., & designer, U.S. Gypsum Co.; 1927 to date, chief designing engr., Dominion Bridge Co., Winnipeg.

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CONTENTS

COVER PICTURE

A Sherman tank broke down near the battle front in Italy. It was taken to an Advanced Workshop Detachment of the Royal Canadian Electrical and Mechanical Engineers. In a few minutes these specialists found a faulty clutch. They went to work immediately, under fire from enemy guns. The repair crew was compelled to "take cover" from enemy gun fire twice. In a few hours they had the satisfaction of seeing the Sherman join in the battle. (*Canadian Army Overseas Photo.*)

INDUCTIVE CO-ORDINATION ASPECTS OF MERCURY ARC RECTIFIER INSTALLATIONS

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Paper delivered before a joint meeting of the Montreal Branch of The Engineering Institute of Canada and the American Institute of Electrical Engineers on December 16th, 1943.

This paper deals with the effects of mercury arc rectifiers on the co-ordination of power supply lines and communication lines. The subject has been treated at length in technical papers and publications, some of which are listed in the appended bibliography; the purpose here is to review the overall problem and to discuss its more important aspects.

As an introduction to the main subject, a brief summary will be given of the co-ordination problem. Noise induction① is the part of the problem of special interest and the remarks will be confined to it.

Noise induced from power supply circuits into circuits used for transmission of speech or music is caused by the harmonic frequency voltages and currents present in the power system wave shape. The interfering effect of a foreign voltage on a telephone circuit depends on its frequency. The interfering effect increases with frequency up to a certain value and then decreases. The voltage induced in a telephone circuit by a given amount of voltage or current on a power supply circuit depends on the frequency, the mutual relation or coupling being directly proportional to frequency. When considering the effect of harmonics present on the power circuits, it is necessary to give due weight to both factors. The term "inductive influence" is used in speaking about them. The inductive influence of a power system voltage or current wave shape is measured in terms of "Telephone Influence Factor"② abbreviated "T.I.F", which factor takes into account both the variation of interfering effect with frequency and the variation of coupling with frequency. Figure 1 shows two T.I.F curves, one marked 1935 and the other tentative 1941.② The shape of the curve depends, of necessity, on the characteristics of the telephone instruments in use and the change from the 1935 curve to the 1941 curve reflects the changes which have been made in improving telephone instruments. The 1941 curve is just coming into use now and the majority of the investigations made in recent years have been based on the 1935 T.I.F weighting curve.

The co-ordination problem introduced by mercury arc rectifiers appears on both the D.C. and the A.C. circuits connected to them. The D.C. problem was the first one to be encountered and it will be treated first here. Incidentally, it is of interest that the problem was first encountered in Montreal and that the control measures applied on that installation are still generally used. The discussion, which follows, of effects on both the D.C. and A.C. systems applies specifically to polyphase rectifiers of the common mercury cathode type. It also applies in general to single anode rectifiers of the mercury cathode type operating either in glass bulbs or metal tanks.

Effects on Direct Current Systems

The common cathode mercury arc rectifier is usually built with 6 or 12 phases. Figure 2-A is a schematic diagram of one of the common methods of operating a six-phase rectifier. Figure 2-B shows the wave shape of the D.C. voltage at no load and Figure 2-C shows it under load. The voltage consists of a D.C. component with a ripple superimposed on it. The ripple can be analysed into a series of harmonic frequencies. Table I shows the harmonic voltages expressed as percentages of the average D.C. voltage.③ The frequencies shown are for a 60-cycle system. The first column of percentages shows theoretical values calculated for no load and the other column shows ranges of values which have been measured in certain cases. Only a limited number of measurements are represented and values outside this range may be expected.

TABLE I

HARMONIC VOLTAGES ON DIRECT CURRENT OUTPUT OF 6-PHASE, 60 CYCLE RECTIFIER

Order of Harmonic	Frequency of Harmonic	Percentage Ratio of Effective Harmonic Voltage to Average Direct-Current Voltage	
		No Load (Theoretical)	Measured Under Load
6	360	4.04	4.5 to 5.95
12	720	0.98	1.26 " 1.37
18	1080	0.44	0.53 " 0.90
24	1440	0.25	0.61 " 0.72
30	1800	0.16	0.40 " 0.80
36	2160	0.11	0.43 " 0.62
42	2520	0.08	0.41 " 0.44
48	2880	0.06	0.35 " 0.36

It will be noted that the harmonic frequencies are 360 cycles and multiples thereof, namely 360, 720, 1080, 1440, etc. The series of harmonics is represented by (ps) where p is the number of phases and s is any whole number. The magnitudes of the harmonics decrease with increasing frequency.

With a higher number of phases, for example 12 phases, for an ideal installation, the harmonics present would be 720 cycles and its multiples. In practice it is found that all the harmonics present with a 6-phase group are present but 360 cycles, 1080 cycles, etc., are reduced in magnitude, the reduction depending on the characteristics of the installation.

Filtering equipment has proved to be generally the most satisfactory method of controlling the harmonics impressed on the D.C. system.④ Figure 3 is a schematic diagram of the equipment. It consists of a reactor in

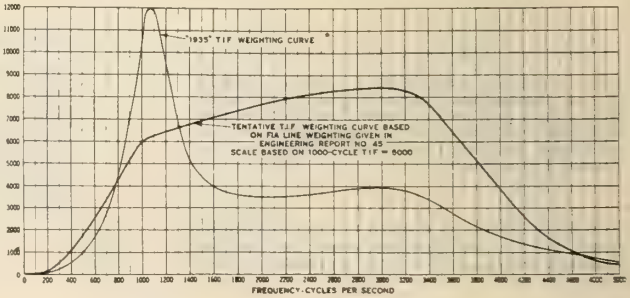


Fig. 1—Comparison of tentative 1941 T.I.F. weighting and T.I.F. weighting adopted in 1935.

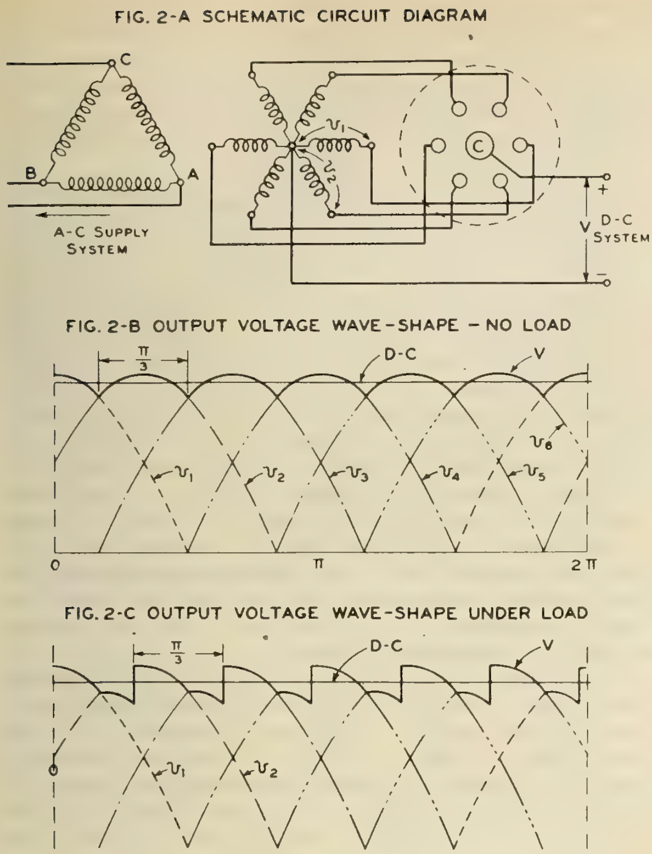


Fig. 2—Six-phase mercury arc rectifier.

series with the circuit and a number of tuned shunts connected across the system on the load side of the reactor. A tuned shunt is required for each of the harmonics which is to be suppressed. The usual experience is that if shunts are provided for 3 or 4 frequencies, they will also reduce to some extent all the higher frequencies present. The design of the filtering equipment depends of course on the characteristics of the particular case. It is generally quite practicable to make it such that the voltage T.I.F on the D.C. system is comparable to the values found on systems supplied by rotating machines.

The problem of co-ordination with the D.C. system arises usually only where rectifiers are used to supply traction circuits, either street railways or other electrified railways. In most other cases the D.C. circuits are confined to the immediate vicinity of the load and are short, and it is possible to avoid communication circuit exposures to them.

Effects on Alternating Current Systems

It is a characteristic of a mercury arc rectifier that harmonics are present in the load current taken from the A.C. circuit even though they are not present in the generated voltage applied to the supply system.⑤,⑥,⑦ To assist in obtaining some idea of what happens, consider an ideal case in which the A.C. voltage is a pure sine wave and the impedance of the A.C. supply circuit and of the rectifier transformer are negligibly low. Referring to Figure 4-A, the wave form I_A shows the current in one phase of the 3-phase circuit supplying a 6-phase rectifier.⑨ Wave form I_B is the same quantity for a 6-phase rectifier with a different connection of the primary of the rectifier transformer. One primary is star and the other is delta. The wave shapes depart markedly from a sine wave.

Analysis of the wave shape of I_A or I_B shows that it consists of a series of harmonics represented by ($ps\pm1$) where p is the number of phases and s is any whole number.⑨ For a 6-phase rectifier, the frequencies are the odd non-triple harmonics and for a 60-cycle system they are 300 and 420, 660 and 780, 1020 and 1140, etc. The magnitude of the nth harmonic is $1/n$ times the magnitude of the fundamental frequency current. The currents are identical in each phase of the 3-phase supply circuit so the harmonics introduced are balanced components.

The distortion of the voltage wave shape depends on the impedance at harmonic frequencies looking back into the power system. A simplified view of what occurs may be obtained by considering the rectifier as a generator of high internal impedance which feeds back into the power supply system. Figure 5 is a schematic diagram which demonstrates the action.⑥ Since the rectifier load is a balanced 3-phase load and the effects are alike for each phase, the diagram shows the circuit for only one phase to neutral.

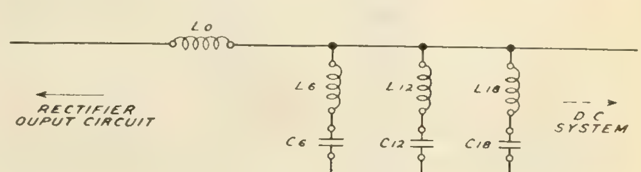
Examination of the diagram helps in understanding a number of conclusions which have been reached as a result of measurements on rectifier installations. E_n is the harmonic voltage produced by the rectifier and it acts on a circuit consisting of the internal resistance of the rectifier R_o in series with Z_{tn}, the impedance of the rectifier transformer, and Z_{sn}, the impedance looking back into the supply system.

(1) The harmonic currents increase with increasing load on the rectifiers. This corresponds to a reduction of R_o, the rectifier internal resistance, as the load increases.

(2) For a particular rectifier, the harmonic currents depend on the total impedance in the circuit, namely, on the rectifier load, and the impedances of the rectifier transformer and of the supply system.

(3) The harmonic voltages appearing on the supply system depend on the harmonic currents flowing and also on the system impedance Z_{sn}. The voltage is directly proportional to Z_{sn} for a particular value of current.
Any arrangement of the power system which reduces the impedance looking back into it from the rectifier will usually reduce the voltage wave shape distortion. Conversely, an increase in the system impedance will increase the effects.

(4) The larger the rating of the rectifier is, the lower will be its internal resistance and the impedances of the rectifier transformer and supply system. Hence the harmonic currents increase with the load rating of the rectifier.



RELATIONS BETWEEN SHUNT CONSTANTS
ASSUMING 60 CYCLE SUPPLY SYSTEM

$$2\pi(360)L_6 = \frac{1}{2\pi(360)C_6}$$

$$2\pi(720)L_{12} = \frac{1}{2\pi(720)C_{12}}$$

$$2\pi(1080)L_{18} = \frac{1}{2\pi(1080)C_{18}}$$

Fig. 3—Filter for 6-phase mercury arc rectifier—Schematic circuit diagram.

The harmonic voltage, E_n, produced by the rectifier depends on a number of factors. An important one is the amount of phase control used to vary the D.C. voltage and the load taken by the rectifier. For small values of phase control, the change is not great but, beyond a few per cent, the harmonic currents increase rapidly with increasing phase control. There is also evidence that the wave shape distortion depends on the nature of the D.C. load supplied by the rectifier.

Multi-phase Operation⑧,⑨

In the early investigations of the effects of rectifiers on A.C. power system wave shape, it was found that the distortion was less for 12-phase operation than for 6-phase. Figure 4-A shows two 6-phase rectifiers arranged for 12-phase operation by using a star-connected primary for one of the rectifier transformers and a delta-connected primary for the other.⑨ As mentioned previously, wave forms I_A and I_B show the wave shape of the currents in one phase of the 3-phase circuit supplying each 6-phase rectifier. I_C is the current to the 12-phase group and is the sum of I_A and I_B. Wave form I_C shows its wave shape and it is seen to approach a sine wave more closely than either I_A or I_B.

In a polyphase rectifier, each anode fires once during each cycle of the applied voltage and they are arranged symmetrically so that the time intervals between the firing of successive anodes are equal. For a rectifier with p phases, the phase interval between anodes which fire successively is $360/p$ deg.

In a 6-phase rectifier, the phase interval between the firing of successive anodes is 60 deg. and in a 12-phase rectifier it is 30 deg. If a number of 6-phase units are associated in such a manner that the phase interval between the firing of successive anodes is decreased, it is equivalent to increasing the number of phases. For example, 15 deg. between successive anodes corresponds to 24-phase operation, 12 deg. to 30-phase operation, 10 deg. to 36-phase operation, etc.

For ideal conditions the harmonics produced in the A.C. system would be the series $(ps\pm1)$ where p is the equivalent number of phases and s is any whole number. For 30-phase operation, the lowest harmonics would be the 29th and 31st, corresponding to frequencies of 1740 and 1860 cycles on a 60-cycle system. Table II shows, for such theoretical conditions, the harmonics which would be present for different numbers of rectifier phases.⑨ The magnitudes of the harmonic currents are shown in per cent of the fundamental frequency current. The table is made up for a 60-cycle system. On a 25-cycle system, the harmonics and the percentages would be the same but the frequencies would be lower in proportion to the fundamental frequency. In practice, the harmonics which are shown as suppressed are only partially suppressed, the amount depending on the characteristics of the installation and the manner in which the rectifiers are operated.

A number of methods may be used for obtaining multi-phase operation. In general the individual rectifiers, if multi anode, or groups of rectifiers if single anode units are used, are 6-phase. Two common methods of obtaining 12-phase operation are shown in Figure 4.⑨ Figure 4-A shows the use of star and delta primaries on the rectifier transformers to obtain the

TABLE II

Relation Between Harmonics in Theoretical Supply-Circuit Current and Number of Rectifier Phases

Order of harmonic	Frequency on 60-cycle system	Harmonic currents in per cent of fundamental number of rectifier phases								
		6	12	18	24	30	36	48	60	72
5	300	20.0	0	0	0	0	0	0	0	0
7	420	14.3	0	0	0	0	0	0	0	0
11	660	9.09	9.09	0	0	0	0	0	0	0
13	780	7.69	7.69	0	0	0	0	0	0	0
17	1020	5.88	0	5.88	0	0	0	0	0	0
19	1140	5.26	0	5.26	0	0	0	0	0	0
23	1380	4.35	4.35	0	4.35	0	0	0	0	0
25	1500	4.00	4.00	0	4.00	0	0	0	0	0
29	1740	3.45	0	0	0	3.45	0	0	0	0
31	1860	3.23	0	0	0	3.23	0	0	0	0
35	2100	2.86	2.86	2.86	0	0	2.86	0	0	0
37	2220	2.70	2.70	2.70	0	0	2.70	0	0	0
41	2460	2.44	0	0	0	0	0	0	0	0
43	2580	2.33	0	0	0	0	0	0	0	0
47	2820	2.13	2.13	0	2.13	0	0	2.13	0	0
49	2940	2.04	2.04	0	2.04	0	0	2.04	0	0
53	3180	1.89	0	1.89	0	0	0	0	0	0
55	3300	1.82	0	1.82	0	0	0	0	0	0
59	3540	1.70	1.70	0	0	1.70	0	0	1.70	0
61	3660	1.64	1.64	0	0	1.64	0	0	1.64	0
65	3900	1.54	0	0	0	0	0	0	0	0
67	4020	1.49	0	0	0	0	0	0	0	0
71	4260	1.41	1.41	1.41	1.41	0	1.41	0	0	1.41
73	4380	1.37	1.37	1.37	1.37	0	1.37	0	0	1.37
Current T.I.F.		1060	515	913	318	183	140	116	65	26

30 deg. phase displacement. Figure 4-B shows the use of 2 sets of 6-phase zig-zag secondary windings on the rectifier transformer. The zig-zag connection provides a 15-deg. phase displacement and one set is connected to advance the anode voltages 15 deg. while the other set retards 15 deg, thereby providing a 30-deg. displacement between the two sets.

Phase displacement in 3-phase circuits may be made readily by means of phase shifting transformers as shown schematically in Figure 6.⑧,⑨ The supply circuit is connected to terminals A, B and C and the load circuit to terminals A′, B′ and C′. The vector diagram indicates how the secondary voltages are shifted with respect to the primary. The transformer can be designed to provide phase shift of any value up to 120 deg. By interchanging the supply and load connections, it can be made either plus or minus.

Figure 7 shows two methods of using phase shifting transformers to obtain 36-phase operation with six 6-phase units.⑨ The first method employs phase shifting transformers to do all the phase shifting. All the rectifier transformers are alike. It will be noted that as much as +25 deg. is required in one phase shifting transformer and −25 deg. in another. The second method employs phase shifting transformers in association with delta and star primaries on the rectifier transformers. In this way it is possible to limit the maximum shift, to be provided by phase shifting transformers, to 10 deg.

It was stated above that the harmonics which are shown as suppressed with ideal multi-phase operation are only partially suppressed in an actual case. To obtain the maximum amount of suppression, the following requirements should be observed.

All units comprising the multi-phase group should be identical and should be carrying the same load. If phase control is used, it should be substantially the same for all units.

The impedance of the rectifier transformer plus that of the phase shifting transformers, if used, should be identical for each 6 — or 12 — phase unit. If phase shifting transformers are not needed for some of the units, reactors of equal impedance may need to be substituted.

The phase shifting transformers or other devices used should provide exactly the phase displacement required. Even a small departure at the fundamental frequency will be large when referred to the higher harmonic frequencies.

In some installations, suppression ratios of as high as 80 to 1 have been obtained for the harmonics below about the 19th. For the higher frequencies it is not possible to do so well and ratios of the order of 5 to 1 are more common.

If one or more 6-phase units of a multiphase group are shut down, balanced multi-phase operation is no longer obtained. The magnitude of the effects on power system wave shape may be deduced by looking at the condition as follows. Assume a perfectly balanced multiphase group of p phases in which all harmonics below $(p \pm 1)$ are suppressed. If one 6-phase unit is shut down, the harmonics appearing on the system apart from the $(p \pm 1)$ harmonics correspond to those which would

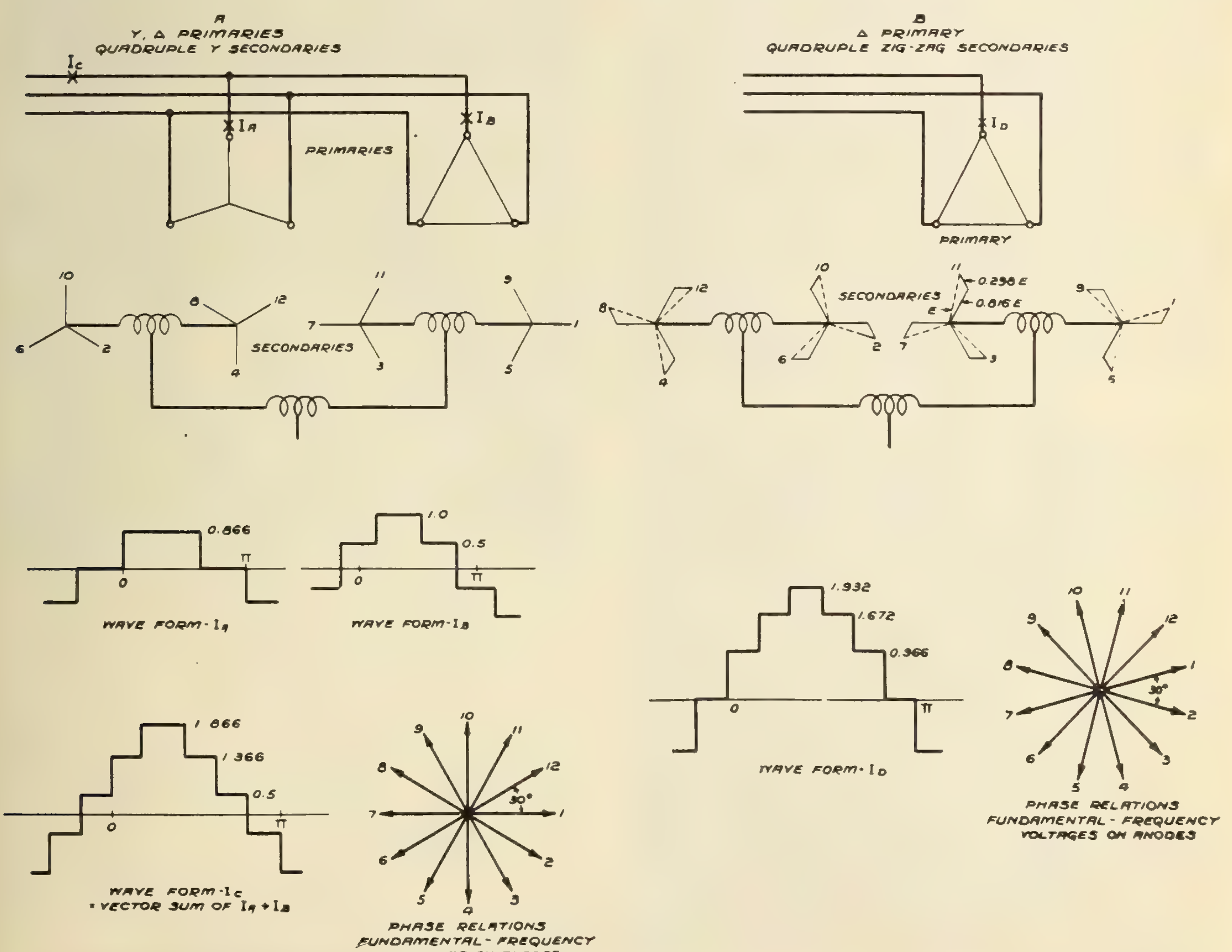
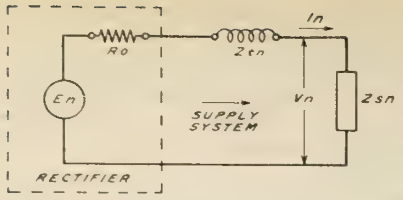


Fig. 4—Twelve-phase rectifier arrangements—Schematic circuits and wave forms.



E_n = Harmonic voltage produced by the rectifier.
R_o = Rectifier internal resistance
n = Order of harmonic
Z_{tn} = Rectifier transformer reactance at the nth harmonic.
Z_{sn} = Phase to neutral system impedance external to the rectifier transformer at the nth harmonic.
V_n = Harmonic phase to neutral line voltage due to the rectifier.
I_n = Harmonic line current due to the rectifier.

Fig. 5—Schematic diagram showing harmonics in supply circuit to rectifier (phase-to-neutral equivalent circuit).

exist if this 6-phase unit were operating alone and carrying its normal load.

As the number of phases in a multi-phase group is increased, the benefits obtained are limited by the above factors. With a large number of units, it is more difficult to maintain all the conditions required to obtain the results which are theoretically possible.

Characteristics of Power Supply Systems

Considerable attention has been given to the manner in which the characteristics of the rectifiers affect the magnitude of the harmonics produced. The characteristics of the power system are also important in determining the wave shape distortion, particularly at a distance from the rectifier load. The impedances of items of power equipment such as generators, transformers, etc., increase proportionally to frequency and are largely inductive reactances over the frequency range of interest. The impedances presented by transmission lines may be either inductive or capacitative reactance and may vary from one to the other over the frequency range. It will be seen, therefore, that if the power supply system is extensive the impedance looking back into it from the rectifier will be a very complex function of frequency.[10] The wave shape distortion which a rectifier would cause in these circumstances would differ markedly from what it would be if the system impedance were uniform over the frequency range or varied in a simple manner with frequency.

Other Control Measures

Other means of controlling the wave shape distortion are feasible in certain situations. If exposures of communication circuits exist only in some parts of the power system, it may be possible to operate the system in such a manner that the wave shape distortion does not extend to that part or is reduced to such an extent that it is no longer troublesome. Usually there are disadvantages to following a plan which hampers the flexibility of the power system and this means may not be looked upon with favour as a permanent solution. It may be very helpful, however, in the interval pending the application of permanent measures.

There are situations in which the use of frequency selective devices or filters in the power supply system are the best solution. Such devices may be shunt capacitors, series reactors or any combination of such items. Cases where these devices might apply are as follows. With well balanced multi-phase operation the lowest unsuppressed harmonics are sometimes the chief components of the T.I.F. Selective devices for these two frequencies will improve the wave shape greatly without being unduly costly.

Cases occur in which the characteristics of the power system are such that resonance occurs at a harmonic frequency and the magnitude of that frequency is increased out of proportion to the others. Filters to take out the one frequency will make marked improvements. A factor to be considered in connection with filters is that in some instances they may be associated with the part of the power system where they are needed and hence their current and voltage rating will usually be lower than would be required if they were installed at the rectifier.

Discussion

All rectifier installations do not introduce co-ordination problems. However, when problems do arise they may be serious and widespread. The effects may be manifest over a large part of a power network or they may appear in any part of it. In some cases they appear in remote parts of the system without causing trouble in the vicinity of the rectifier. If the equipment is already operating, co-ordinative measures are apt to be costly and difficult to install, and communication services will be adversely affected in the meantime. To forestall such occurrences it is desirable that all parties concerned in rectifier installations should co-operate to investigate the possible effects on co-ordination with communication circuits at the earliest opportunity.

Information on a number of methods of estimating the harmonic voltages and currents produced by rectifiers has been published.[5],[6],[7] They include calculations involving characteristics of the rectifiers and the impedance of the power supply system at harmonic frequencies. It is necessary to make simplifying assumptions to facilitate calculation, and a very close check between actual and estimated results cannot be expected. Experience does indicate, however, that the

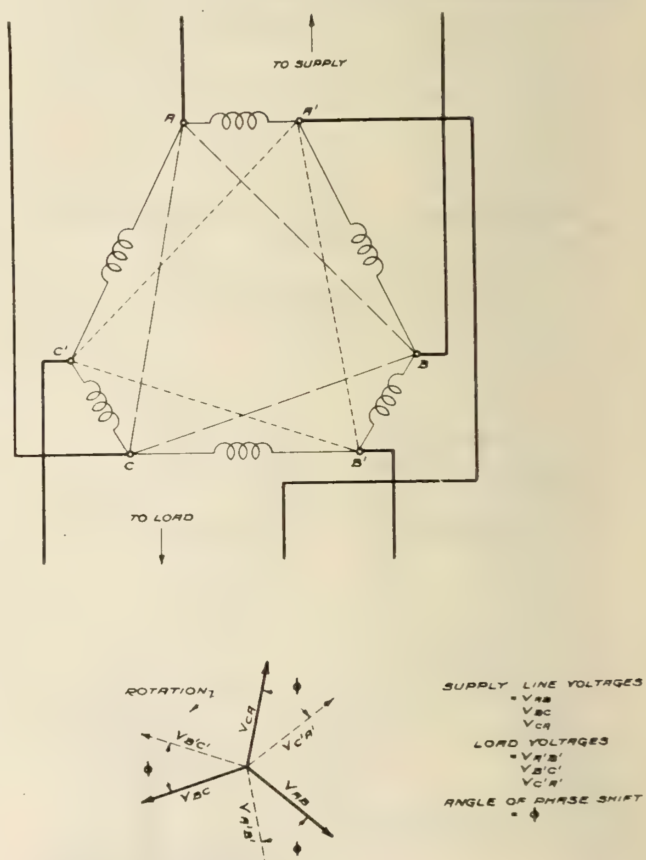


Fig. 6—Phase-shifting transformer—Schematic and vector diagrams.

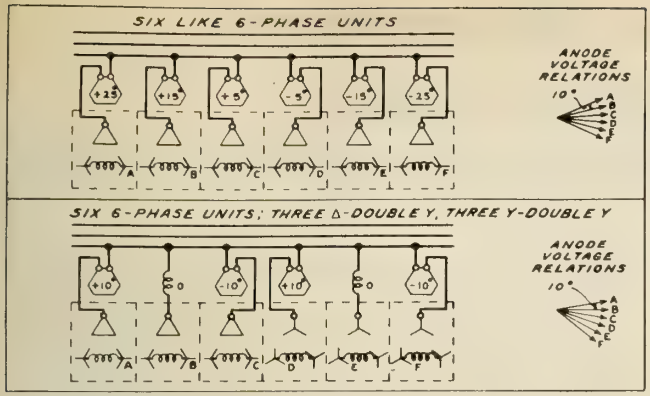


Fig. 7—Two methods of providing 36-phase operation with 6-phase units and phase shifting transformers.

methods are useful as a basis of judgment regarding the extent and seriousness of wave shape distortion.

For many years before the war there was extensive growth in power systems, particularly in distribution lines, and communication circuit exposures were being created on a large scale. During the same period, the wave shape of the power systems was being improved gradually and this was one factor in making it possible to co-ordinate the two types of circuits without incurring excessive costs specifically for that purpose. The advent of large mercury arc rectifier installations has threatened to reverse the trend and is a challenge to the utilities involved.

About 1938, a large mercury arc rectifier installation was put in operation in the United States and excessive noise induction was caused on communication circuits over an extensive area.⑧ Development work, in which the manufacturer and the purchaser of the rectifiers and the communication company participated, led to the practical application of multi-phase operation as a means of controlling wave shape distortion. Since that time, there has been extremely rapid growth in the installed capacity of mercury arc rectifiers in connection with electro-chemical and electro-metallurgical industries. In Eastern Canada alone, mercury arc rectifiers now total more than a million kilowatts. Multi-phase operation has been used widely and has prevented what would otherwise have been widespread co-ordination problems. The types of loads mentioned above are well suited to multi-phase operation since it is possible to operate large groups of rectifiers in parallel on both the D.C. and A.C. sides and the loads are substantially constant throughout the day. These conditions cannot be looked for in all the applications which will be made when rectifiers are available to fill all demands.

As regards the future, new problems can be expected in connection with rectifiers and other types of electronic devices. In addition to use in traction systems and in the electro-chemical and electro-metallurgical industries, rectifiers have been used widely as a source of D.C. for high power radio stations. It is expected that, in the future, they will be used wherever conversion from A.C. to D.C. is required, for example, to supply large D.C. motors in steel mills and similar industries. Direct current transmission of power has been under development for many years. When it comes into general use, it will involve both rectifiers and inverters, and wave shape distortion may appear on the A.C. systems at each end and on the D.C. link. A similar situation will be introduced by electronic type frequency changers used either to supply higher frequency power for industrial purposes or to interconnect power systems of different frequencies.

We do not know the solutions to all these problems or even the precise nature they will take. What can be stated definitely however, is that they can be solved and that the best solutions will be obtained if all parties concerned co-operate wholeheartedly to that end.

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THE ENGINEER AND THE COMMUNITY

JOHN S. GALBRAITH, M.E.I.C.
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An address delivered at the Fifty-Ninth Annual General Professional Meeting of The Engineering Institute of Canada, at Winnipeg, Man., on February 7th, 1945.

Nearly every profession but that of engineering is closely associated with the family life of a community — my doctor, my lawyer, my dentist are all every-day expressions; and it is commonplace to hear a housewife say my butcher, my baker — even my ice-man — but who ever heard the engineer referred to in these possessive, intimate terms by all the members of a family? It is not because the family does not need his services, but rather because the average family does not know the engineer or understand how he may be of assistance to it. I believe the ordinary citizen looks upon the engineer as a mystery-man — a stranger — a romantic figure who lives apart in a different world. This attitude may have had its origin in the days when the frontiers were far from home, in "the wild and woolly West". Now that the frontiers are the urban and rural communities themselves, now that the frontiers are on our very door steps, the engineer who builds frontiers of every description, must introduce himself and make friends with Mr. and Mrs. Jack Canuck and help those friends to get the sort of communities they want and need.

What kind of community design do people want? Why do they need the services of the engineer? Both these questions will be answered by understanding how the engineer thinks and works. The engineer's training, experience and practice are centred on what is known as functional design. To understand what this means, let one examine a radio, a steam engine, an electric motor, an automobile or another structure symbolizing mechanical progress. The designer of the motor car did not begin by making a spark plug or a pneumatic tire, nor a hand brake. He started by knowing what he wanted to achieve, then he went to work to devise ways and means of accomplishing it. In other words, he first had a well defined aim, next he made an overall plan for the kind of vehicle which would be needed to accomplish this aim, he then applied scientific principles to the design of the whole machine and each of its parts, so that when fitted together each part would serve the rest and the whole machine each part; that is what functional design means. It is the way the engineer thinks and works. It is the way the overall and individual structures of a community should be designed and built. It is the reason why the engineer is the key man in community planning.

Slums, traffic congestion, crowded cities have made Canadians land conscious. They say Canada is a vast country. We possess all kinds of transportation means, provincial governments have constructed great networks of highways to distribute people. Why concentrate so many people in one centre? Why have big cities? Why make narrow lots which pack houses together in tight monotonous rows? Canadians all over Canada want to know the answers to these questions — that is why they are interested in community planning. They know that planning shapes the community, the neighbourhood, the lot, and they also know that the shape of the lot shapes the house which plays so important a role in shaping the lives of the family which dwells in it. That is what makes the planner the family engineer.

In my view, cities are suffering more from the *lack of understanding how to plan* than from the *lack of planning effort.* Unsuccessful planning efforts, in my opinion, are due to failure to recognize the scope of community planning, to failure to plan the various elements that condition the physical structure of a community, to failure to plan these elements so that they will serve each other and work in harmony to produce the necessary overall physical structure. The main elements which condition the physical structure of a community include the economic base of a community, the municipal tax structure, the system of municipal assessment, the functional land-use plan, the zoning regulations, and last but not least "the rural base" upon which a community depends for its supply of food. In my view, realistic planning is impossible until appropriate measures are introduced to make land-use flexible and fluid.

Under the present system of municipal assessment, assessed values govern the use of land, not functional design. The first step in community planning is to devise a system of assessment which permits functional design to determine the use of land. Municipal postwar projects conditioned on the present assessment system, not functional design, are, in my opinion doomed to ultimate failure. Take for example a "traffic artery project" planned to relieve congestion; its costs will be recapitalized in higher assessments, higher assessments will develop higher rentals, higher rentals call for higher intensities in the use of land, the more intensive use of land creates further congestion, which in turn demands new and costly measures to relieve it. A rising spiral of cause and effect is thus set in motion. In consequence of project planning, our large cities are gradually becoming monstrosities not fit for human habitation.

We have promised men and women in uniform and overalls that a fresh start will be made at the end of the war. The fulfilment of this promise calls for action and for technical leadership which visualizes the community as a whole, which envisages the overall picture, not a miscellaneous lot of projects. We need leaders with engineering training, who design their entire structures as units; there is no lack of specialists; National Housing legislation is ready. It is predicated on a solid foundation. The Federal Government is responsible to all the people of Canada for moneys advanced to finance housing. In order to protect investments and borrowers alike, the National Housing Act makes adequate community planning and appropriate zoning regulations conditions for long-term housing loans.

Under the British North America Act, the provincial governments enjoy the privilege of enacting municipal legislation. Consequently, the provinces are responsible for enacting legislation necessary for proper planning. The Engineering Institute of Canada and its branches can do much to educate the public and in other ways help provincial administrations with such tasks. With respect to handling the politicians and general public, it may be said that the engineer has accustomed himself to think in terms of straight lines — the shortest distance between two points — and that he is not always understood by others. Although straight line thinking is right to the point, it is not always possible to get prompt action along these lines; Ruskin may have "had something" as the boys says, when he said "there is nothing more monotonous than a straight line" and Mae West may have "said something" when she defined a curved line as "the loveliest distance between two points". Perhaps a mixture of these ideas would help the engineer, the politicians and the public to a better, all round understanding.

It may take time to recondition the present assessment system; however, in the meantime, the slum clearance provisions of the National Housing legislation make functional design attainable now and a fresh start possible when the war ends, providing municipalities have their plans ready. By providing a large sum of money for outright grants to municipalities, the high assessments on lands now occupied by slum dwellings may be deflated. These areas may be remodelled in accordance with modern design. As they abut upon congested commercial districts, this congestion may be relieved by a re-orientation and widening of the street system in the slum areas, without incurring the ordinary huge expenditures for street widenings. By introducing appropriate zoning regulations and by providing open spaces in the crowded business sections, the daytime population may be more uniformly distributed and the average densities reduced. Legislative measures which provide that suburban subdivisions be divided into rural and not into city lots will protect the close-in rural communities against haphazard intrusion of deficit urbanization.

The engineer may comfort those who are frustrated by the idea of land control by telling them that he places controls on all the machines he makes, and that when these controls fail to function, the machine either stops or runs wild; or the engineer may tell them that when the Great Engineer of the universe made His working drawings for the human form, He equipped the human organism with glands to control and limit the size and shape of the body and its limbs. The Creator also equipped mankind with power to think. Our armed forces are again saving democracy; as freedom entails responsibility, the engineer may also suggest that it is our democratic responsibility and duty to intelligently control the development of our communities.

Manifestly the specialist is not the man to direct in the field of community planning. Our cities are what they are today, largely because the development of municipalities has been departmentalized into special divisions. No clearly defined idea exists as to what the overall picture should be. Most municipalities lack an administrative department to make designs and plans for the overall development. Years of this kind of growth have resulted in an accumulation of evils of all sorts. The economic base of a community has been allowed to grow up on the idea of bigness; in fact our generation has had a mania for bigness: big cities, big business, big wars, big shots; this generation is now turning its attention from bigness to quality. People now speak of better cities, better business, a better world, in which there will be no war, and the only big man left is the one who serves.

A better city may mean less industry and commerce. It may mean a redistribution of industry within the region. It may mean replacing unsuitable industry and commerce by enterprise which "plugs" the gaps and rounds out a programme for maximum employment. Research shows that municipal costs increase with increasing concentrations of population, that larger concentrations mean higher municipal taxes, smaller living quarters and less agreeable surroundings. Research also shows that a large percentage of the area of an urban municipality is deficit area. Consequently, any enterprise unable to support the maintenance of the deficit area it creates will prejudice the whole community. Such enterprise should be located elsewhere where it can help to fill out the industrial structure. If living conditions and maximum employment are made the planning objectives to be achieved, the community's economic base will be conditioned to meet these needs.

Besides knowing what provisions should be included in a comprehensive programme of planning legislation, the planner must have a grasp of the principles involved in all branches of applied science and know how to collect information on a host of other subjects. He should be able to use such information wisely. Because buildings of every description represent certain concentrations of population, the planner employs the principles of statics. He distributes the land loading according to functional arrangement. Functional design makes public services and utilities subservient to the needs of the people. Project planning does the reverse. It subordinates the distribution of population to public services and utilities.

The layman may like to know that public libraries are well supplied with literature on the subject of community planning but, as ever, the most trustworthy authority to follow is none other than "Dame Nature" herself. Her works answer the community planner's every question, her plans are comprehensive and total, her designs are functional, her organization for planning is permanent, her planning is constituted as a continuing process in order to meet changing conditions. She limits the height of forests, she shows mankind that stunted growth and death are the penalties for overcrowding. Nature rebuilds her blighted and burnt-out areas, her highways; the watercourses follow the easiest gradients; her rains cleanse the air; the sun purifies the waters; she paints the landscapes in gorgeous colours; each year she drapes and dresses her structures in new foliage; nothing is permitted to grow shabby. The engineer works with Dame Nature—he understands her language. Therefore, he is the man who ought to be able to make cities as simple, as efficient, as functional and as beautiful as Nature herself.

Finally, I take it that we are gathered here for the purpose of deciding how we can best serve society in its work of building a better world. I may be prejudiced, but I know of no other medium which can do more to help the people of this country than community planning. Canadians grew up in communities, they spend their lives in them. Development of national resources in the provincial and national communities is designed to converge on the local municipalities, both rural and urban. Therefore, let us make

(*Continued on page 78*)

POST-WAR PROJECTS FOR THE PRAIRIES

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An address delivered at the Fifty-Ninth Annual General Professional Meeting of The Engineering Institute of Canada, at Winnipeg, Man., on February 8th, 1945.

It is important that we should try to visualize and do everything within our power to meet a situation which will come upon the country like an avalanche immediately after the war. The government will be faced with an insistent demand for the demobilization of the fighting forces; a demand which no government, however constituted, will be able to resist. Overnight the problem of reconstruction and rehabilitation will be upon us. It will be then, if ever, that the need will be most urgent to get large peace time enterprises under way.

Far-Reaching Projects Needed

It will be then, too, that the country will turn to the engineer. Governments, all governments, will want to know what the engineer has to offer. The problem will not be confined to the returned men only, there are also the tens of thousands of war workers who will be thrown out of employment. The situation cannot be met by half measures. Small projects around town, however numerous, will be entirely inadequate. Jobs for the sake of jobs will not solve the problem. Something will have to be done in a big way.

An act of Parliament cannot, by itself, ensure freedom from want. The high standard of living to which we have become accustomed can only be maintained when the man power of the nation is fully and gainfully employed in constructive enterprises. Enterprises must be planned that are designed to stimulate the national economy. If this is done, forces will be released that will set the wheels of industry rolling forward on the high road of greater national achievement. It has been said before: in time of war, prepare for peace. We must prepare for D Day on the home front. This great task offers a challenge to us all and to no one more than to the engineer. We must not flag or fail in this great task that is just ahead. We must not! we will not let our fighting men down!

The economy of this country is predominantly agricultural. It follows, therefore, that measures designed for the rehabilitation of agriculture will automatically strengthen the whole national economy and create the conditions requisite for greater national growth and well-being. In this, the engineer working in conjunction with the agriculturist has a major part to play and nowhere more so than on the broad, open face of the western prairies, where the hazards of farming, from one cause and another, are so great. While we regret the circumstance—a national emergency owing to the great drought of the thirties—which made the step necessary, I think it is right to say that we are fortunate in having an organization in operation which is experienced in rehabilitation work; an organization competent to take on a much greater job, if and when the green light is given. At this point, a word on the range of our organization's activities might not be out of place.

P.F.R.A. Activities

The Prairie Farm Rehabilitation Act was passed in the spring of 1935 and now applies to an area of 122,737,000 acres in the three prairie provinces. The programme of the administration was just getting well under way when the war intervened and, in common with other peace organizations, the administration had to adjust its programme to wartime conditions. Fortunately, and notwithstanding reduced appropriations and other handicaps, no important activity of the administration has had to be discontinued.

In arranging the programme to meet the conditions imposed by the war, first consideration had to be given to projects which required only a minimum of labour and materials. Projects in which large quantities of steel and other scarce war materials were required are being held in abeyance. By following this policy, the administration has carried out, even during the war years, a reasonable programme of construction and, what is equally important, has maintained an organization geared to undertake projects, however large, if suddenly called upon to do so. In furtherance of this policy too, surveys, investigations and studies, of one kind and another are being conducted. These investigations are not confined only to the engineering feasibility of a project, but include agricultural and economic studies as well. These economic studies ensure, among other things, that public money is not being wasted on half-baked, unsound or visionary enterprises. The great bulk of P.F.R.A. work is not particularly spectacular. The work can best be described as ordinary, everyday "spade work" in a field which offers almost unlimited scope for expansion if an "all out" effort is put forth for the rehabilitation of agriculture on a national scale.

As I have already indicated, P.F.R.A. was primarily formed as a measure to meet an emergency created by extensive drought conditions over a large section of the prairie provinces during the thirties. Happily, for the time being at least, that emergency has passed but other circumstances remain and the administration finds itself dealing more and more with problems created by factors of an enduring and permanent nature such as climatic variability and soil conditions with consequent hazards and limitations to agricultural production. This condition is certainly not confined to the so-called drought area, or for that matter, to the prairie provinces only. Doubtless it was such considerations that weighed with the Parliamentary Committee on Reconstruction and Re-establishment when they recommended that the Act be made applicable to "all of Canada".

Expressed in general terms, the main activities of the P.F.R.A. have to do with measures for the conservation and utilization of surface or run-off water, and the reclamation of submarginal lands, together with the rehabilitation of settlers situated on these lands.

Scope of Its Work

The work is classified under three main divisions:

1. Cultural.
2. Land Utilization.
3. Water Development.

The cultural work can be shortly stated as embodying farming practices and systems of agriculture best suited to climatic and soil conditions in particular regions and includes, of course, a great deal of research and experimentation.

The land utilization work is based on soil surveys supplemented with economic studies in a given locality. As these soil studies are the scientific basis for proper land use and therefore indispensable in planning a rehabilitation programme for agriculture, this work can and should be greatly expanded.

The third division of the work, water development, is the subject with which we are more particularly concerned in this paper. It is now a well recognized fact that low and variable rainfall rather than lack of soil fertility (except in definitely submarginal areas) is the limiting factor in crop production on the open plains. It is good economy and sound public policy, therefore, to conserve by every feasible means, our precious water resources so limited on the prairies, yet so essential to national prosperity and well-being. The prairie farmer is forever waging a constant and relentless battle against the recurring ravages of droughts, for which irrigation is the only permanent solution—water is liquid gold on these prairies!

True, only a very small portion of our agricultural land in the low rainfall area can be commanded by the ditch. The situation is not without hope, however. Fortunately, the rivers and streams bisect the country in a way that favours the low rainfall area. Fortunately too, feasible sites for dams and reservoirs are found at strategic points where large areas of suitable and good land can be brought under irrigation. The policy is to take advantage of this natural situation. Consequently, large dams and reservoirs have already been constructed on the Frenchman, Souris and Qu'Appelle rivers, on Swift Current creek and on other streams and water courses. Suitable reservoir and dam sites have been located on the main rivers which, when fully developed, will bring hundreds of thousands of acres of new land under irrigation. These projects, totalling approximately $30,000,000, have all been fully investigated and are now ready for immediate construction as post-war projects. Other projects are being investigated, which if found feasible, will add another $70,000,000, making an estimated grand total of well over $100,000,000. All these projects are within the present P.F.R.A. area.

It is well to point out here that the initial expenditures on the construction of the main works of these irrigation projects is only a part, usually the smaller part, of the ultimate development. The opportunities, therefore, which the development of irrigation opens up for permanent and gainful employment cannot be too strongly stressed. This employment factor, beginning with the construction of the primary works, carries progressively through all stages of development, building up in the process a new economy based on intensified farming, particularly on the production of specialty crops, sugar beets, canning crops and the like. In this connection, perhaps I cannot do better than quote from the report of the St. Mary and Milk Rivers Water Development Committee, This committee which made a special study of the present irrigation development in the province of Alberta, says on page 53 of its report under the sub-heading "Industrial Development":

> "The industrial development resulting from irrigation is contributing very substantially to the general welfare of southern Alberta and to the country as a whole. Two sugar factories for processing sugar beets, and two factories for the canning of a wide assortment of products from irrigated lands, and, in addition, seed cleaning plants, alfalfa meal mills, commercial apiaries, and other enterprises attendant directly or indirectly on irrigation and increased trade have been established in the area.
>
> "Were it not for irrigation, the city of Lethbridge would depend entirely on coal mining, ranching and wheat growing for its trade, and would not have achieved, as reported, the distinction of having the highest retail trade per capita in Canada during one or more of the depression years when relief in various forms was being distributed in large sections of the prairie provinces".

Some Typical Projects

Much as engineers desire precise information on projects as such, time will permit only a brief reference to one or two which may be taken as typical of the aims and objects sought.

St. Mary and Milk Rivers Water Development

Of the larger projects, perhaps the best known because of its international aspects, is the "St. Mary and Milk Rivers Water Development Project". The nature and benefits of this project involve the construction of a storage dam on the St. Mary river a few miles northeast of Cardston, Alberta, together with numerous other reservoirs, certain river diversions and canals to carry water across southern Alberta to within a few miles of the city of Medicine Hat. This project, if and when constructed, will make possible full use of Canada's share of the water of the St. Mary river—an international stream. The full development of this project will bring under the ditch 345,000 acres of land now either unproductive or only in very limited production under dry farming practices or in pasture. The estimated cost of the project is $15,000,000 and, during construction of the works, 1,000 men will be employed steadily for five years. This is, of course, exclusive of the indirect labour required for the preparation of material and supplies.

Red Deer River Diversion

Another project I might mention is "The Red Deer River Diversion" which is part of the North Saskatchewan River Project or better known as the William Pearce Stockwatering Scheme. Details of this large scheme I believe, which had originally as its objective the irrigation of approximately 1,400,000 acres, are already in the records of this Institute. The project as it now stands, after five years of continuous investigation and study by P.F.R.A. engineers, has been much reduced from the original scheme. The project now recommended involves the construction of a dam on the Red Deer river approximately thirty miles east of the city of Red Deer, Alberta, and a canal to Hamilton and Kirkpatrick lakes just south of the town of Coronation, Alberta. From these lakes, water will be carried through natural channels to the drought areas of east-central Alberta and central-western Saskatchewan. The estimated cost of the project is $6,750,000. Labour required in the construction of the works will be 1,500 men steadily for eighteen months. Again this does not include the indirect labour required in the preparation of materials, nor that required in servicing the purchasing power of the men and their families while employed on the work. The chief benefits of the project will be:

(1) Opportunities for settlement, permanent homes and means of livelihood for 7,500 families in a section of western Canada from which over 90 per cent of the original settlers were forced out by drought; it can, therefore, resettle an area now practically depopulated; the area will support between 30,000 and 40,000 people.

(2) It will provide irrigation for approximately

500,000 acres of land suitable for irrigation. This land is not now in production and is, for the most part, publicly owned. In addition to the lands which can be irrigated, it will give a constant flow to 610 miles of dry creek channels traversing an area containing 12 million acres of range lands and will materially increase the livestock carrying capacity of such lands. The project will also rehabilitate 24 urban communities now practically depopulated from years of drought.

A Boon to National Economy

It will be apparent that a post-war programme such as I have indicated, should not be regarded in the narrow sense of a "works programme" only. We like to think and speak of it in broader and more comprehensive terms, preferably in terms of reconstruction and rehabilitation, for in its wider aspects, that is what it is. Apart altogether from the advantage of creating immediate employment, other and more permanent benefits will accrue, not only to the individual but to the state as well, benefits far in excess of the amount of money spent on the initial construction of the works.

It is hard to visualize the revolutionary effect on western agriculture which the full development of our water resources for irrigation would bring about. If we have vision, enterprise and courage, nothing can stop us!

In conclusion: I have been able to deal with only one P.F.R.A. activity and only lightly on that. The "overall" programme is much more comprehensive. It is designed not only to overcome unfavourable conditions of soil and climatic variability but also to give leadership in conservation practices and the application of scientific principles to proper land use. The future is bright along a new horizon—the horizon of new opportunity.

THE ENGINEER AND THE COMMUNITY

(*Continued from page 75*)

the rural and urban communities living monuments to those who have suffered and died that Canada might live.

Engineers may do this by helping the people in each community to clarify their ideas about the kind of community they want. Engineers can show the results which will follow if they do this, that or the other. By planning the whole community before its parts, the engineer can make man the master of his environment. Project planning by itself will make man a slave to his environment. The Engineering Institute of Canada can help university authorities to establish courses in this all-embracing subject. It may assist legislators to design the proper legislative tools necessary to shape the physical structure of a community. The Institute can assist the planning movement throughout this country by promoting a Community Planning Institute of Canada.

The engineer can lead the family
and community to victory in peace!

DEFENDANT'S FACTUM

(*Continued from page 100*)

the case of a church it would appear at once that the engineering problems only arose out of the nature of the material the architects wished to employ in the construction of the building or out of the shape or form they desired to give to the building.

If the construction of this machine shop is examined, it will be seen that all the features are in the engineering category, and these features do not arise from the nature of the materials to be used in the construction of the building, or from the form that might be desired to give to the building, but arise from the nature of the works to be housed in the building. In other words, the building is made to conform to the operation of the machines housed therein. The design of a church is governed to a very great extent by the appearance desired to be given to the structure. A church is to a great extent a monument.

Our seventh contention is that the evidence supports the proposition that the Harrington Tool & Die Shop was a mechanical work. All the Defendant's experts classified the building as a mechanical work, and there has been no evidence to the contrary. Witnesses for the Plaintiff have testified that they could have prepared the plans and specifications for the Harrington building—it is quite possible, but absolutely immaterial. The issue is not whether architects have the capacity and ability to design and specify a machine shop of this kind, but whether the work done by the Defendant is, or forms part of a mechanical or other engineering work.

No doubt it is for the Court to decide whether it is a mechanical or other engineering work, but seeing the members of the Plaintiff Association have not denied and the Defendant experts have testified that it is both engineering and mechanical, we submit with respect, that the uncontradicted opinion of experts is entitled to the Court's consideration.

Montreal, January 5th, 1945.

(Signed)

Chauvin, Walker & Martineau,
Attorneys for Defendant.

True Copy.

Attorney for Defendant.

REPORT OF THE COUNCIL FOR THE YEAR 1944

Together with Committee and Branch Reports

The annual report of Council is the sum of the reports of committees plus certain "vital statistics" prepared by Headquarters. Words on paper cannot transmit the hopes and ambitions, the successes and the failures, the efforts and the results of a year's work in an organization like the Institute. The authors of committee reports follow conventional lines, thereby concealing from the casual reader much of the effort made and some of the success attained. Consequently this report is largely just a cataloguing of the eventful year of 1944, nevertheless in justice to the committees and in the interest of the profession, each member should read the report. Only in this way can one get a picture of the Institute in action. When it is realized that approximately five hundred members are serving on committees, the value of these reports becomes apparent.

There is no better manifestation of an engineer's loyalty to his profession and his society than his service on committees. The Institute has been more than ordinarily fortunate in these things. Leading engineers in many places have given freely of their time and effort to serve the Institute, particularly in the position of chairmen of committees. Council is very grateful to every one of them.

Again the membership total has reached a new level —6,717 is where it stands at the end of the year. An encouraging sign is that a large portion of the increase has come from student applications. There are now over 1,800 students in the Institute. This figure, along with that of 800 Juniors, indicates that the Institute is remaining young in spite of its years.

Compared on a population basis, the new membership is equivalent to 80,000 members in an American society. The largest professional engineering organization in that country has approximately 20,000 members.

An examination of the reports of the Finance Committee and of the Treasurer indicate that finances are in good shape. The year has been finished with an increased surplus, as compared to previous years, even though increased activities have added to expenses.

Presidential Visits to Branches: Once again it has been possible for a president to visit every branch of the Institute and every university but one where engineering is taught. This is no small accomplishment, and again attests to the sacrifices made by leading engineers in support of the Institute. Presidency makes great demands upon its incumbent. In 1944, the president attended over fifty meetings, at which he was either the chairman or the special speaker. He has travelled about 200,000 miles to carry out his duties These figures give some indication of the size of the task, but it is not so easy to find a measure that will describe the great good done for branches and for the profession by these visits.

Council Meetings: During the year the policy of holding regional meetings in various parts of Canada was continued. Six meetings out of the twelve took place outside of Montreal, at Edmonton, Toronto, Ottawa, Kingston, Quebec, and Halifax. The average attendance at the twelve meetings was fourteen, and out of forty-eight councillors, forty attended at least one meeting and represented twenty-two out of the twenty-five branches.

Annual Meeting at Quebec: In the history of the Institute, few meeting have been as successful as the one held in 1944. With a registration of almost 900, it was the second largest meeting ever held. In addition to the large registration, there were many other outstanding features. The local committee arranged and carried out a programme full of intricate detail, and established such standards of hospitality that the membership will look forward to visiting Quebec again at the earliest possible date.

Work of Committees: The year saw unusual activity on the part of many committees, as can be seen from the following reports. Outstanding in the field was the work of the Committee on Employment Conditions, established early in the year to advise the Institute membership on the very important subject of collective bargaining. New committees were established late in the year on Statistical Control of Quality in Production, and on Soil Tests. No report from either of these committees is included in council's report, as the work of organization was completed only at the year's end. It is likely that both committees will be heard from frequently during 1945.

Cooperative Agreements: An event of great significance occurred late in the year, when the ballot submitted to their membership by the Corporation of Professional Engineers of Quebec and by the Engineering Institute relative to a cooperative agreement, was approved by both organizations. This is a great step forward in practical cooperation. It is planned that the signing ceremony will take place early in January.

Engineers' Council for Professional Development: The important work which is being carried out by this organization was advanced materially in the last twelve months. Considerable progress was made on further tests of aptitude and measurement in relation to students and prospective students in engineering. An informative and helpful report was also prepared by the committees dealing with Technical Institutes. The Engineering Institute has continued to take a very active part in all these deliberations, and has shared with the other seven organizations in the expansion of the work previously undertaken and of new subjects added to the programme.

The Engineering Journal: Throughout the year, the *Journal* suffered from restrictions placed by the Wartime Prices & Trade Board with regard to the supply of paper. Many changes had to be made by way of reducing the total amount of paper consumed, but in spite of this handicap, the total number of pages printed was not affected seriously, although in certain numbers this reduction was quite noticeable. A feature of the year, as far as the *Journal* was concerned, was the publication of the Shipshaw numbers in May.

In the future some amelioration of the restrictions has been arranged so that additional paper will be available in 1945 to take care of the expansion in membership due to the greater student activity and the cooperative agreement in the province of Quebec. In this way it is hoped that in the coming year the *Journal* can be restored to something like its previous character.

New Horizons: As the membership approaches 7,000 and as new activities are constantly being brought to the attention of Council, it apparent that the Institute has reached a new stage in its development. There are great opportunities to render a greater and an improved service to the profession and to the public served by the profession. To take full advantage of these opportunities will require changes from previous procedures. Principal among these may be a change in annual fees. At the last council meeting of the year, the Finance Committee was instructed to examine this problem and to report to the annual meeting of Council in Winnipeg in the month of February. To make a change of this kind it will be necessary to have by-law amendments, and therefore, if decided upon, could not be made effective before 1947. In the meantime, Council has asked Corporate Members and Juniors for voluntary contributions in order to establish a fund whereby one member may be assigned full time to the task of assisting members in uniform at the time of their demobilization. The notation regarding this voluntary assessment will be found on all the 1945 accounts.

Members on Active Service

It is difficult to present the story of members participating in the services. The field of activity is so far-flung, and the pressure of matters of greater importance so urgent that Headquarters gets little more than an outline of what is being done.

The records show that eleven hundred members are in uniform but the division between overseas and in Canada is impossible to make. The situation is changing constantly so that the figures, if they were obtainable, would not mean much. Likewise with casualties, promotions and decorations, it is almost impossible to assemble the complete story as it might apply at any one time.

Certain it is, that members are making a substantial contribution in all parts of the world, and it is hoped that eventually the whole story may be presented through the medium of the *Journal*. In the meantime Council wishes to express to all members in uniform its appreciation of the efforts and the sacrifices they are making and the honour they are bringing to their profession.

To date there are four hundred and twenty-three members serving overseas, made up as follows:—

Members	113
Juniors	98
Students	208
Affiliates	4
	423

Roll of the Institute

The membership of all classifications now totals 6,717, which again is a record. New names added for the year 1944 amounted to 779, but deaths, resignations and removals reduce the net figure to a gain of 644.

During the year, 760 candidates were elected to various grades of membership. These were classified as follows: Honorary Members, 2; Members, 182; Juniors, 52; Students, 518; Affiliates, 6. The elections for the previous year totalled 546. Nineteen reinstatements were effected, and 12 life memberships were granted.

Transfers from one grade to another were as follows: Junior to Member, 37; Student to Member, 23; Affiliate to Member, 1; Student to Junior, 102, a total of 163.

The names of those elected or transferred are published in the *Journal* each month immediately following their election.

Removals From the Roll

There have been removed from the roll during the year for non-payment of fees and by resignation, 40 Members; 9 Juniors; 23 Students, and 9 Affiliates, a total of 81.

Deceased Members

During the year 1944 the deaths of fifty-four members of the Institute have been reported as follows:—

Honorary Member

Desbarats, Georges Joseph

Members

Atwood, William Stephen
Blanchard, Aubrey B.
Bogart, John Laurence Haslett
Braden, Norman Short
Breithaupt, William Henry
Chapais, Charles
Coutlee, Charles Robert
Cox, Leonard Martin
Cummings, Eugene Walker Dimock
Dalkin, George Robert
Darling, Fred Steere
Dawson, William Bell
Dubuc, Arthur Edouard
Dunne, Hugh Joseph
Evans, Edwin George
Ewart, Henry Edward
Fay, Frederic Harold
Fisher, Seymour J.
Foreman, Alvah Ernest
Freeland, John James
Gurnham, Robert Allan
Hanning, George Foster
Harris, Richard Crosby
Hertzberg, Charles Sumner Lund
Howard, Laurence James Meredith
Hunter, James Henderson
Johnston, Charles
Junkins, Sydney Edwin
Kenny, Walter Robert
Kingston, Charles Burrard
Lefebvre, Olivier Odilon
Morgan, Alfred Hedley
Mutchler, James Irving
Newton, Samuel Robert
Newell, Fred
Newman, John James
Palmer, Robert Edward
Patterson, Thomas Bilton
Penman, Alan Carleton
Plamondon, Adrien
Porter, John Bonsall
Reilly, Francis Bell
Ross, Cecil Middleton
Russell, William B.

Segre, Beresford Henry
Smart, Russell Sutherland
Stansfield, Alfred
Thorne, Benjamin Leonard
Wilson, Harry Alton
Woodman, John

Junior

Dugas, Alexandre (killed in France)

Students

Jacobs, David Sinclair (killed following air operations in France)
Logie, Richard Bucknam (died in Normandy)

Total Membership

The membership of the Institute as at December 31st, 1944, totals 6,717. The corresponding number for the year 1943 was 6,073.

	1943	1944
Honorary Members	17	17
Members	3,820	3,988
Juniors	665	773
Students	1,471	1,843
Affiliates	100	96
	6,073	6,717

Respectfully submitted on behalf of the Council,

de Gaspé Beaubien, m.e.i.c., *President*

L. Austin Wright, m.e.i.c., *General Secretary*

PUBLICATION COMMITTEE

During the course of the year, your committee's principal problem has been to publish all the papers and discussions that were available and at the same time keep within the allotment of paper. This meant, in many cases, rather drastic editing of the copy.

The steps taken early in the year were insufficient to meet the administrative requirements, with the result that in August we were advised that a further reduction must be made immediately in order to cut down the overdraft.

To do this, the following changes in the makeup of the *Journal* were made—

(1) The list of the officers of the Institute and of the members of committees, and of the executives of the branches, will be published every three months instead of every month.

(2) The advertisers' classified directory and the pages of industrial news have been eliminated.

(3) The weight of paper in the front advertising section will be reduced as soon as the printer's present stock of the heavier paper is used.

Your committee has discussed a suggestion that the *Journal* should be sent to the officers' messes of engineering units overseas. To date, a feasible method of carrying this out has not been evolved. The matter is being given further consideration.

The committee has before it proposals for other changes which will improve the publication, but cannot authorize them until certain additional editorial and reportorial facilities are available. It is believed that there are unusual opportunities now to make the *Journal* more useful to the profession, and the committee hopes that these can be taken advantage of before long.

Your committee approved the publication of a second edition of the booklet "The Profession of Engineering in Canada," as revised by the Committee on the Training and Welfare of the Young Engineer.

The committee believes that the May issue of the *Journal* which contained all the papers on Shipshaw was particularly valuable to all engineers. It acknowledges its indebtedness to the authors and to Aluminum Company of Canada for their combined efforts, which made this number possible.

Respectfully submitted,

R. S. Eadie, m.e.i.c., *Chairman.*

LEGISLATION COMMITTEE

The year 1944 was noteworthy as far as legislation affecting the profession was concerned, although none of it dealt directly with the legislation of the Institute.

There were two far-reaching developments. (a) Proposals for collective bargaining legislation for professional workers; and (b) action taken by the Province of Quebec Association of Architects against Bryan R. Perry, m.e.i.c., for having made plans of an industrial building.

Because of the widespread implications of the collective bargaining issue, a special committee was established by Council under the chairmanship of R. E. Heartz, and the subject will be covered thoroughly in the report of that committee. The action of the architects has been reported from time to time in the *Journal* and as no judgment has been handed down at this date there is no additional news to report.

Respectfully submitted,

P. E. Poitras, m.e.i.c., *Chairman.*

EMPLOYMENT SERVICE

In spite of increasing Institute activities at Headquarters, it has been possible to maintain the Employment Service to the extent required by calls from employers and from members.

The return to civil life, which has begun from at least one of the armed services, caused a sudden revival of activity in the last four months of the year and has demonstrated the necessity for a reorganization of these facilities. Many calls have also been received in recent weeks from employers who are considering reorganizing their staffs for peacetime production.

The fact that both members and employers have come to the Institute in this connection would indicate that they expect it to perform a function supplementary to the work undertaken by the Government in this field. Council's decision to add another person to the staff, whose sole duties will be the rehabilitation of members from the services and from war industry, is an indication that the Institute will meet its responsibility. It should result in a more efficient operation of the Employment Service than is possible with the present facilities.

Last summer, the Director of Personnel of UNRRA (United Nations Relief and Rehabilitation Administration) came to the Institute for assistance in recruiting technical personnel from Canada for work in liberated countries of Europe. The vacancies were advertised in the *Journal* and 110 applications were handled through Headquarters. Some of the applicants were interviewed in Canada by officials from

Washington. Recent information received at the Institute indicates that there is at present a lull in the activities of UNRRA's personnel department, as a result of the military situation in Europe. However it is expected that recruiting may be resumed in the course of the next few months.

The following table gives comparative figures of the work done in the Employment Service Bureau, in addition to the special assignment carried out for UNRRA:

	1943	1944
Members registered for employment....	59	72
Non-members registered for employment	46	43
Number of members advertising for a position	21	28
Replies received from employers........	30	40
Vacant positions registered	113	195
Vacancies advertised in the *Journal*.....	36	38
Replies received to advertised positions..	93	80
Personnel records forwarded to prospective employers.....................	13	16
Men notified of vacancies..............	91	181
Placements definitely known...........	19	22

Respectfully submitted,

LOUIS TRUDEL, M.E.I.C., *Assistant General Secretary.*

LIBRARY AND HOUSE COMMITTEE

Your committee has authorized very little expenditure at Headquarters this year, as the building was found to be in good repair. Because of the need of more space, the assistant general secretary moved his office upstairs to what was formerly the committee room. It was necessary to redecorate and to relight the room for the purpose.

The increase in membership in all branches and the general increase in activities due partly to the war have increased the work of the staff, and have added to the congestion at Headquarters. The committee commends the work of the staff and compliments its members on their loyalty and support.

It is with regret that we announce the resignation of Miss Elizabeth Power who, for three years, has so capably filled the post of librarian. In her place, Mrs. Lawrence Short, a graduate of the McGill Library School, assumed these duties on January 1st, 1945.

The statistics customarily reported to indicate the extent to which members use the library are as follows:

LIBRARY

Books for review	67
Books presented	20
Proc. and Trans..............	23
Reports	257
Books reviewed..............	3
Requests for information	2,717
By phone	1,268
By letters..................	1,070
In person	379
Books and periodicals loaned..	936
Photostats	12 blueprints
20 orders...................	189 negatives
Bibliographies prepared.......	24

The use of the library has been increased, principally by the student members. With the purchase of new books which are expected to arrive at the beginning of the year, it should be used to an even greater extent. Revision of the library arrangement has been started which will allow more space for expansion.

The new books and the rearrangement are made possible by the $200.00 granted annually by the Finance Committee for this purpose.

It is urged that members interested in the library make suggestions for its improvement and recommend suitable technical books for its expansion.

The committee wishes to remind members outside Montreal that these facilities are available to them also, on the same basis as members in Montreal, the only difference being that out of town members are asked to pay postage charges. All that is required is that a cheque for five dollars be sent along with the request. This cheque will be returned when the book arrives back at Headquarters.

Respectfully submitted,

E. V. GAGE, M.E.I.C., *Chairman.*

BOARD OF EXAMINERS AND EDUCATION

Your Board of Examiners and Education for the year 1944 has had prepared and read the following examination papers with the results as indicated:

SCHEDULE C—	Number of Candidates	Number Passing
Electrical Engineering—		
III. A. General Paper.....	2	0
III. B. Utilization of Electric Power.........	2	0
Structural Engineering—		
VII. A. General Paper.....	1	1
Chemical Engineering—		
I. A. General Paper.......	1	1
I. B. Water Softening.....	1	1
SCHDEULE B—		
I. Elementary Physics and Mechanics......	5	3
II. A. Strength and Elasticity of Materials....	6	2

The Board recommends that the schedule of examinations and the rules and regulations applying thereto be reviewed with the object of improving them and of bringing them up to date.

Respectfully submitted,

R. A. SPENCER, M.E.I.C., *Chairman.*

COMMITTEE ON INDUSTRIAL RELATIONS

Since the last annual meeting the Committee on Industrial Relations has held three meetings, on 2nd June, 23rd June and 6th December.

The committee has continued its activities in arranging for papers to be prepared for publication in the *Journal*, and, below is a complete list together with date of publication:

The Significance of Industrial Relations, by E. A. Allcut and J. A. Coote—Oct. 1942.

A Scientific Approach to the Problem of Employee Relations, by Prof. M. S. Viteles—March 1943.

The Role of the Industrial Relations Executive in Company Management, by Bryce M. Stewart—March 1943.

Trends in Industrial Relations, by Prof. J. C. Cameron—December 1943.

Some Observations on Benefit Plans for Canadian Workers, by M. A. Mackenzie and N. E. Sheppard—January 1944.

Job Evaluation, by D. W. Weed—February 1944.

Social Security Planning in the English-speaking World, by Maurice Stack—March 1944.

Effective Foremanship, by D. D. Pannabaker—May 1944.

Nutrition in Relation to Efficiency, by Dr. K. E. Dowd—November 1944.

Paper in regard to R.C.A.F. Rehabilitation Schemes, by Group Captain S. N. F. Chant—December 1944.

All papers submitted for publication have now appeared in the Journal or are in print, and the committee is informed that they have been well received.

During the current year, the position of engineers under Order-in-Council 1003 has been under considerable discussion, and the committee submitted to Council a memorandum of its views in this matter.

The committee has continued to study and discuss the question of retraining and rehabilitation of men returning to industry from the Armed Forces. One meeting of the committee was attended by Group Captain Chant, Deputy Director, Personnel Direction and Research, R.C.A.F., and the information given to the committee by Group Captain Chant in connection with rehabilitation work in the Air Force was later, at the request of the committee, put by them in the form of an article for publication in the *Journal*. The study of different aspects of this question is continuing actively.

In view of the appointment of a special committee of the Institute on employment conditions, the Committee on Industrial Relations is not at present taking further action in regard to its collective bargaining studies, but it has arranged to be kept in close touch with the work performed by the Committee on Employment Conditions.

Respectfully submitted,

WILLS MACLACHLAN, M.E.I.C.,
Chairman.

NOMINATING COMMITTEE

Chairman: R. L. Dunsmore, M.E.I.C.

Branch	*Representative*
Border Cities	C. G. R. Armstrong
Calgary	F. K. Beach
Cape Breton	M. R. Chappell
Edmonton	E. Nelson
Halifax	C. Scrymgeour
Hamilton	W. J. W. Reid
Kingston	D. C. Macpherson
Lakehead	H. G. O'Leary
Lethbridge	H. T. Miard
London	T. L. McManamna
Moncton	A. Gordon
Montreal	L. H. Burpee
Niagara Peninsula	J. H. Ings
Ottawa	L. M. Christmas
Peterborough	W. T. Fanjoy
Quebec	J. O. Martineau
Saguenay	N. F. McCaghey
Saint John	A. R. Crookshank
Saskatchewan	A. P. Linton
Sault Ste. Marie	R. A. Campbell
St. Maurice Valley	M. Eaton
Toronto	N. MacNicol
Vancouver	T. V. Berry
Victoria	S. H. Frame
Winnipeg	J. T. Dyment

COMMITTEE ON PRAIRIE WATER PROBLEMS

A meeting of the Prairie Water Problems Committee of The Engineering Institute of Canada, under the chairmanship of G. A. Gaherty, was held in the Palliser Hotel, Calgary, on October 24th, 1944. Those present were Messrs.:

de Gaspé Beaubien	D. W. Hays
G. A. Gaherty	G. N. Houston
P. M. Sauder	P. J. Jennings
S. G. Porter	T. D. Stanley
A. Griffin	L. A. Wright
L. C. Charlesworth	

As this was the first meeting of the committee for some time, discussion of a future course of action took place. It was felt that as regards suggested projects in addition to the St. Mary's project, this committee should not push one as against another, but should be ready to advise the Dominion Government in such a manner that the development of irrigation would be on a sound engineering basis.

The question of expanding existing systems instead of developing new projects was discussed. As there were several projects which could be brought into production within a year after the war, it was felt that they should be brought to the attention of the Government as they would fill a need for immediate employment on the construction, and would bring land into production at once to be used for settlement by returned soldiers and by industrial workers who wished to return to farming. Some discussion took place as to the ability of the average soldier farmer to handle irrigated land.

Ways and means of bringing the Institute's views before the Government were discussed at some length, and it was suggested by Mr. Gaherty that a western sub-committee should be formed, this sub-committee to study the questions on the ground and to prepare the necessary data and reports for the eastern members to present to the Government at the opportune moment. This was agreed to and P. M. Sauder was appointed chairman of the sub-committee and T. D. Stanley, secretary.

The appointment of engineers to positions on the P.F.R.A. was also brought up and Mr. Austin Wright told what had been done by the Institute with the Government in this regard.

Respectfully submitted,

G. A. GAHERTY, M.E.I.C.,
Chairman.

COMMITTEE ON THE ENGINEER IN THE CIVIL SERVICE

This committee was continued during 1944 with a "watching brief". The main work was accomplished in 1943, and the only activity during 1944 was a conference with the Civil Service Commission in order to present to that body the further views of our committee relative to salaries of technical men in the Civil Service. The Civil Service Commission gave Mr. Westman and the chairman of this committee a good hearing, and after laying before the Commission our views we were assured that the Commission would take them into consideration in the forthcoming report which was to be presented to the Treasury Board. What the results of this report will be we do not know, but it would appear that the continued interest of the committee and its readiness to offer suggestions as well as criticisms has had some effect upon the department.

Respectfully submitted,

N. B. MACROSTIE, 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 31st, 1944, are submitted herewith and, as may be seen, the Institute has had, from the financial standpoint, a most successful year.

The securities in the Institute's investment funds, totalling $12,366.39 for the account of Special Funds and $32,064.66 for the account of General Funds, have been checked and found in order.

The statement shows an increase in revenue from Membership Fees of $2,564.27 or of approximately 7 per cent as compared with the previous year and an increase in revenue from publications of $6,707.24 or of approximately 21 per cent. On the other hand, total expenditures, exclusive of an item of $5,000.00 transferred to Contingent Reserve, show an increase of but $3,930.13 or of less than 5¾ per cent. The showing undoubtedly reflects great credit on the Institute's General Secretary and his staff.

During the year the Institute has purchased and has taken delivery of $5,000.00 Dominion of Canada 7th Victory Loan bonds against which it has borrowed a like amount with the expectation that the loan will be repaid as the annual membership fees are paid for the year 1945.

Respectfully submitted,

R. E. Chadwick, M.E.I.C.,
Treasurer.

FINANCE COMMITTEE

Your Finance Committee is pleased to report a satisfactory year for the Institute, but would stress that certain conditions of a temporary nature have increased our surplus.

COMPARATIVE STATEMENT OF REVENUE AND EXPENDITURE

For the year ended 31st December, 1944

Revenue

	1944	Comparative for 1943
Membership Fees:		
Arrears	$ 4,032.47	$ 4,219.28
Current	31,450.03	29,614.40
Advance	814.25	618.55
Entrance	3,233.75	2,514.00
	$39,530.50	$36,966.23
Publications:		
Journal Subscriptions	$ 9,800.48	$ 8,909.31
Journal Sales	152.38	76.50
Journal Advertising	28,866.64	23,126.45
	$38,819.50	$32,112.26
Income from Investments	$ 980.36	848.31
Refund of Hall Expense	400.00	505.00
Sundry Revenue	56.03	3.44
Total Revenue for Year	$79,786.39	$70,435.24

Expenditure

	1944	Comparative for 1943
Building Expense:		
Property and Water Taxes	$ 1,324.74	$ 1,326.79
Fuel	568.76	636.92
Insurance	189.08	175.00
Light, Gas and Power	347.81	360.88
Caretakers Wages and Services	1,218.00	1,068.00
House Expense and Repairs	515.03	1,096.96
Building Fund Reserve	—	1,500.00
	$ 4,163.42	$ 6,164.55
Publications:		
Journal Salaries and Expense	$25,498.75	$24,537.31
Sundry Printing	2,108.15	891.52
	$27,606.90	$25,428.83
Office Expense:		
Salaries	$17,844.92	$16,865.59
Telegrams, Postage and Excise Stamps	1,518.92	1,420.65
Telephones	720.42	646.59
Office Supplies and Stationery	2,281.21	1,536.12
Audit and Legal Fees	390.00	255.00
Messenger and Express	136.60	141.93
Miscellaneous Expense	648.56	646.54
Depreciation—Furniture and Fixtures	342.95	364.48
	$23,883.58	$21,876.90
General Expense:		
Annual and Professional Meetings	$ 1,642.56	$ 1,371.86
Meetings of Council	746.61	747.89
Travelling	1,841.12	1,540.67
Branch Stationery	188.26	122.25
Prizes	334.53	357.05
Library Salary and Expense	2,151.48	1,900.54
Interest, Discount and Exchange	69.55	176.55
Committee Expenses	1,836.27	1,095.22
National Construction Council	100.00	150.00
Sundry Expense	359.04	189.09
	$ 9,269.42	$ 7,651.12
Rebates to Branches	$6,840.61	$ 6,712.40
Transfer to Contingent Reserve	5,000.00	—
Total Expenditures	$76,763.93	$67,833.80
Surplus for Year	3,022.46	2,601.44
	$79,786.39	$70,435.24

Our main sources of revenue are, of course, membership fees and advertising from the *Journal*. Both of these, you will note, have increased materially. On the other hand, the cost of printing the *Journal* is abnormally low because of the ceiling price, and it is entirely probable that this situation will not last much longer. In addition to this, Headquarters is very much understaffed due to the increase in membership and activities, so that our expenditure for salaries is likely to be greater in 1945.

Your committee has set aside $5,000. for contingencies, and we feel that this is very low in view of special expenses which are now foreseen and which may be incurred in the near future.

The special funds, including the Past Presidents' fund, have been consolidated to facilitate accounting. I might say that this has been done on the strong recommendation of our auditors. We are also pleased to report that the Past Presidents' fund has been augmented during the past year and a further fund established by one of the past presidents for the annual presentation of a copy of "Pioneers of Science" to the retiring president.

Respectfully submitted,

C. K. McLeod, m.e.i.c.,
Chairman.

COMMITTEE ON THE TRAINING AND WELFARE OF THE YOUNG ENGINEER

The Committee on the Training and Welfare of the Young Engineer asks leave to make its sixth annual report.

Student Selection and Guidance

The demand for the booklet "The Profession of Engi-

COMPARATIVE STATEMENT OF ASSETS AND LIABILITIES

As at 31st December, 1944

Assets		1944	Comparative for 1943
Current:			
Cash on hand and in Bank		$ 1,621.99	$ 871.36
Accounts Receivable, less Reserve		6,602.90	5,087.96
Arrears of Fees—estimated		2,500.00	2,500.00
Army Technical Development Board		72.44	1,767.65
		$10,797.33	$10,226.97
Special Funds—Investment Account:			
Investments—at cost	$12,366.39		
Cash in Savings Accounts	2,224.79		
		14,591.18	7,104.61
Investments at Cost		32,064.66	26,558.51
(Market Value as at 31st December, 1944, $33,250.00)			
Sundry Advances		250.00	250.00
Deposit with Postmaster		100.00	100.00
Prepaid Insurance		275.00	78.50
Gold Medal		45.00	45.00
Library—At cost less depreciation		1,448.13	1,448.13
Furniture and Fixtures—			
At cost	$16,262.60		
Less: Depreciation	13,176.02		
		3,086.58	2,915.85
Land and Buildings—Cost less depreciation		36,000.00	36,000.00
		$98,657.88	$84,727.57

Liabilities		1944	Comparative for 1943
Current:			
Bank Loan—Secured		$ 5,000.00	$ 6,507.44
Accounts Payable		3,039.15	2,976.67
Rebates to Branches		230.87	376.63
		$ 8,270.02	$ 9,860.74
Special Funds:			
As per Statement attached		14,591.18	7,092.61
Reserves:			
Building Fund		5,000.00	5,000.00
Building Maintenance		2,000.00	2,000.00
Contingent Reserve		5,000.00	—
Surplus Account:			
Balance as at 31st December, 1943	$60,774.22		
Add: Excess of Revenue over Expenditure for year as per Statement attached	3,022.46		
		63,796.68	60,774.22
		$98,657.88	$84,727.57

Audit Certificate

We have audited the books and vouchers of The Engineering Institute of Canada for the year ended 31st December, 1944, 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 1944, as attached, are properly drawn up so as to exhibit a true and correct view of the Institute's affairs as at 31st December, 1944 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, 22nd January, 1945.

neering in Canada," made it necessary that a second edition should be prepared. The booklet was revised and thirteen thousand copies of the second edition were printed at a cost of $387.33. The initial distribution has been completed and includes 3,530 copies to the universities, and 3,000 copies to approximately 1,200 high schools in all nine provinces. Requests have come in for additional copies.

Branch Student Guidance Committees

These committees have been active during the year and the number of counsellors has increased to a present total of about 130. The student guidance programme of the Institute is dependent on the energy and co-operation of these men. Your committee takes this opportunity to thank them for their continued assistance.

The Canadian Committee for Student Guidance in Science and Engineering

The previously reported joint Student Guidance Committee of the E.I.C., the C.I.M.M. and the C.I.C. was re-convened in Ottawa on September 26th and a new committee, to be known as The Canadian Committee for Student Guidance in Science and Engineering, was formed with the following members: John R. Kirkconnell, secretary, representing the C.I.M.M.; Berhard Collitt, representing the C.I.C.; and Harry F. Bennett, chairman, representing the E.I.C.

This committee has been approved by the three Institutes; the E.I.C. by resolution of the Council on Octover 21st, 1944. The student counsellors named separately by each body across Canada automatically became part of the new committee, and these, numbering about 600, were circularized by a bulletin issue during October. A copy of the second edition of the E.I.C. booklet was sent to each counsellor. The letter accompanying this bulletin contained the following paragraph:

> "It is not intended that counselling by your committee should supersede the work which may now be carried on in your locality. We do emphasize co-operation with local groups, universities, and other educational authorities. Our objective is to direct the proper students to the courses in which they probably will be most successful. Suggestions as to methods, reports of experience, etc., are contained in the accompanying Bulletin No. 1. Further bulletins will be issued periodically so that finally no student anticipating a career in science or engineering will find it necessary to enter upon his professional education without first being advised by an experienced counsellor."

Bulletin No. 1 went rather exhaustively into the present activities and future programmes. It is expected that further bulletins will be issued as information becomes available to the central committee.

Co-operation with the Armed Forces

The Student Counsellors of the Institute and of the joint committee are ready to act as consultants to all demobilized members of the Armed Forces who are interested in further training for the profession of engineering. This counselling has begun and your committee has found it a very pleasant duty.

The District Rehabilitation Boards of the Department of Veteran's Affairs have been directed to contact all our Student Guidance Committees throughout Canada for "counsel and advice particularly when dealing with applicants for training in the engineering profession. These men will also be in a position to give advice in connection with industrial requirements and the opportunities for training on the job."

Your committee urges each branch to study the needs in its area so that these men will have the advice they will be seeking at a time when it is needed.

Recommendations

(1) That each branch executive be asked to study this report and to urge its Student Guidance Committee to extend its activities so that every part of the branch district is represented in this work.

(2) That the organization of joint counselling committees, as urged by Bulletin No. 1 of the joint committee, be hastened so that the fields of science and engineering may be covered fully.

(3) That each member of the Institute should give some thought to student guidance, especially those who are in small communities away from the branch centres, so that students and demobilized service men may have local contacts to assist them in their choice of a profession.

Respectfully submitted,

Harry F. Bennett, m.e.i.c.,
Chairman.

COMMITTEE ON EMPLOYMENT CONDITIONS

The Committee on Employment Conditions was set up by the president on May 5th, 1944 because of the implications to the profession of collective bargaining legislation as determined by the then recently promulgated Order in Council P.C. 1003. It was instructed to study the question of employment conditions and to make such recommendations to Council as it deemed necessary in the best interests of the profession.

The members are: Messrs. P. N. Gross, G. N. Martin, B. J. McColl, A. D. Ross, J. D. Sylvester, I. R. Tait, and the chairman.

Brief and Questionnaire

A brief entitled " The Engineer and Collective Bargaining " dated July 10th, 1944 and a questionnaire whereby each member could express a complete opinion on the subject were mailed to all members of the Institute. Replies were received from 2,550 members. Many of the members in the armed forces could not be contacted in sufficient time to reply within the time limit. More than 800 special comments were returned with the questionnaire.

Result of Questionnaire

The outstanding feature of the replies was the uniformity of opinion expressed. In the three age groups selected, namely under thirty, thirty to forty and over forty, there was little difference in opinion. The senior engineers with broad experience expressed themselves similarly to those under thirty with limited experience. There was a definite desire on the part of the older men, themselves not affected by bargaining legislation, to assist in improving the economic status of the young engineer.

Ninety-two per cent of those who returned the questionnaire expressed themselves in favour of collective bargaining by means of a new order (or by amendment to P.C. 1003). As an example of the uniformity of opinion on this question the lowest percentage in favour for any province was 90 and the highest 95. Engineers under thirty years of age were 96% in favour, those from thirty to forty were 94% in favour while those over forty years of age were 90% in favour.

If a new order (or an amendment to P.C. 1003) cannot be obtained, 65% wanted total exclusion from P.C. 1003. On this question the young engineers were 67% in favour of exclusion, the intermediate age group 66% in favour and the senior engineers 64% in favour.

As to the kind of bargaining agency, 90% were in favour of employees' organizations for engineers only, with interlocking of bargaining units by an engineers' group. Less than 1% favoured trade unions as a bargaining agency. If included within a bargaining order 87% expressed themselves as willing to support it morally and financially.

Other interesting information obtained is that 70% of these replying are members of a professional association or corporation.

Special Meetings

Members of the committee have addressed twenty-one branches of the Engineering Institute, attended all meetings at Ottawa of what has become known as the "Committee of Fourteen" and in addition have attended numerous special meetings with other committees and influential groups and persons in various parts of Canada.

Ottawa Meetings

A meeting was held in Ottawa on August 15th for the purpose of reporting the results of the canvass of the membership of the various engineering organizations on collective bargaining, and to decide on a course of action.

The following organizations (whose representatives are now generally referred to as the Committee of Fourteen) were represented at this meeting.

The Engineering Institute of Canada
The Canadian Institute of Mining and Metallurgy
Canadian Institute of Chemistry
The Royal Architectural Institute of Canada
Canadian Society of Forest Engineers
The Canadian Institute of Surveying
The Dominion Council of Professional Engineers
The Association of Professional Engineers of the Province of Ontario
Corporation of Professional Engineers of Quebec
The Association of Professional Engineers of Nova Scotia
Association of Professional Chemists of Quebec
American Institute of Electrical Engineers (Canadian Section)
The Institute of Radio Engineers (Canadian Section)
Junior Graduate Engineers Association of Ottawa

It was agreed unanimously at this meeting:

1. "That this group request the Dominion Government, through the Minister of Labour, to grant professional workers separate legislation for collective bargaining".

2. "That a sub-committee consisting of

   Messrs. O. N. Brown—Can. Institute of Mining & Metallurgy
   A. J. Hazelgrove—Royal Architectural Institute of Canada
   Leon Lortie—Can. Institute of Chemistry
   W. P. Dobson—Dominion Council
   R. E. Heartz—Engineering Institute of Canada

   proceed immediately to draft special legislation for presentation to the Committee of Fourteen at the earliest possible date."

The sub-committee held its first meeting on August 15th and a further meeting on the following day. Mr. Vincent McDonald who had previously been with the legal section of the Department of Labour at Ottawa and was well versed in the many details necessary for legislation of this type was engaged as legal draftsman. Following several meetings the sub-committee presented a proposed draft at a meeting of the Committee of Fourteen at Ottawa on October 3rd. The draft was approved with certain amendments and a committee of three consisting of Messrs. A. E. MacRae, Ottawa, W. P. Dobson, Toronto, and R. E. Heartz, Montreal, was instructed to present the revised draft legislation to the Minister of Labour and also to arrange for the continuance of exclusion from P.C. 1003 pending a final presentation.

The amended legislation was presented to the Minister on November 8th and he advised the Committee of Three on November 11th that the Wartime Labour Relations Board intended to hold some special meetings in connection with the matter in January, preliminary to making a report to himself.

On the advice of the Committee of Three the Committee of Fourteen, with eighteen organizations represented, reassembled in Ottawa on December 20th to discuss the situation again and to approve the brief prepared for presentation to the Wartime Labour Relations Board.

Ottawa Hearing

On January 9th the Commitee of Three presented the brief to the Wartime Labour Relations Board at a public hearing held in the Railway Room of the House of Commons on behalf of twenty organizations of Engineers and Scientists.

The organizations officially represented by the committee were the fourteen organizations above mentioned, less the Association of Professional Engineers of Ontario, and plus seven more who asked the committee to represent them, namely:

The Professional Institute of the Civil Service of Canada
The Illuminating Engineering Society
Ontario Association of Architects
Association of Professional Engineers of Saskatchewan
The Association of Professional Engineers of the Province of Manitoba
Association of Professional Engineers of Alberta
The Association of Professional Engineers of the Province of New Brunswick

Briefs were submitted by the Association of Professional Engineers of Ontario, the Federation of Employee Professional Engineers and Assistants of Ontario; the National Conference of Canadian Universities and the Canadian Association of Scientific Workers. Briefs and statements were also presented by the Trades Unions.

The proposal for new legislation 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 our proposal. The Canadian Manufacturers Association favoured exclusion as the best solution. 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 upon which universities as free associations of scholars are founded." The Ontario Association and Federation supported the proposal.

Present Situation

It is expected that the Board will make a recommendation to the Minister in about a month. The Committee cannot predict the course of subsequent events but it is in almost daily touch with the situation and will continue to take all possible action in furthering the interests of the profession.

Further Information

Additional information on the subject of this report has already appeared in the columns of the *Journal* The brief to the Wartime Labour Relations Board appeared in the January issue and a summary of the discussion and rebuttal will be published in the February number. Copies of the proposed new order were sent to all branches, and the essential features of it are also included in the brief which has been published as stated.

Acknowledgments

Mr. A. E. MacRae was the able chairman of the Ottawa meetings and presented the brief to the Wartime Labour Relations Board very competently indeed. Mr. W. P. Dobson contributed generously of his time, his wisdom and his influence throughout all the many discussions and consultations in different cities, and Mr. L. A. Wright gave immense assistance in his capable performance of the onerous duties of Secretary to the Committee of Fourteen.

The chairman of the Institute Committee on Employment Conditions feels that his committee members have well earned the thanks of the Institute. They have worked arduously, travelled extensively, and have shown a live sense of their responsibility for finding the best practical solution of a difficult problem. Mr. L. Austin Wright acted as secretary of this committee too, and was able with his wide connections to obtain many valuable data from a number of various sources, and generously accommodated himself to the many requirements of the committee. Mr. Louis Trudel likewise gave generously of his time, and the assistance of his services and the support and co-operation of the headquarters staff are gratefully acknowledged.

Respectfully submitted,

R. E. Heartz, M.E.I.C., *Chairman*

COMMITTEE ON THE ENGINEER IN THE ACTIVE SERVICES

The immediate objective of the Committee on the Engineer in the Active Services was to improve the position of the engineers in the Royal Canadian Ordnance Corps. There, the technically trained officers dealing with the mechanical engineering side of ordnance were definitely at a disadvantage in regard to rank and rates of promotion with those on the stores side.

After studying the matter, the committee advocated the formation of a corps in the Canadian service analogous to the Royal Electrical and Mechanical Engineers in the British Army. It also advocated recognition of professional standing in the form of increased pay and rank as has been the practice in the R.E.M.E. and in the Canadian forces in the R.C.A.M.C.

These ideas were presented to the officials concerned and careful consideration of them was promised. At the same time it was indicated that a reform of some sort was being contemplated.

After some months passed and no change was apparent, an interview was sought and obtained with the Minister of National Defence on March 13th last. Later the same day the representatives were received by the Master General of the Ordnance where it was learned that the formation of the R.C.E.M.E. was then well along and that an official announcement was pending, which later was given to *The Engineering Journal.*

After some weeks, certain questions arose regarding the use of non-professional officers in professional positions which formed the basis of editorials in the *Journal,* and letters were sent to the Master General of the Ordnance out of which a conference was arranged between the president and the M.G.O. where the various points were discussed.

It is now felt that the position of the trained engineer officer in the R.C.E.M.E. is definitely improved over that in the R.C.O.C. and the various difficulties inevitable on the formation of a new corps gradually will be worked out.

The questions of professional pay and rank are so involved with army structure and precedent that action on them at present cannot reasonably be expected. However, it is hoped that having our proposals on record will be helpful in any reorganization that takes place later.

The Institute, in pressing for the formation of the new corps, has aided progress in army organization.

There is no measure by which one may gauge the amount of influence that the Institute's interest in this subject exerted on the department's change in policy, but unquestionably it has brought to the attention of government departments and officials the fact that there is a large body of well informed public opinion in the membership of professional societies.

In conclusion, this committee wishes to draw to the attention of the President and Council the fact that the lion's share of the work — if a lion does work — of the committee was done by the general secretary, without whose industry, sagacity and perspicuity little would have been accomplished. This committee is very grateful for his help.

Respectfully submitted,

D. S. Ellis, M.E.I.C., *Chairman.*

COMMITTEE ON ENGINEERING FEATURES OF CIVIL DEFENCE

The final paragraph of this committee's report for 1943 reads as follows:

"Because of improvement in the war situation, and because the special assignments to this committee have been substantially fulfilled, this committee is now less active than heretofore. It is endeavouring however, to maintain its organization, including that of the branch committees, so as to permit of promptly taking up further assignments should that become necessary."

During 1944, due to continuing improvement in the war situation and consequently to lack of any essential work which this committee might undertake, it has been entirely quiescent. Present prospects are that this condition will not change.

The organization of this committee has been maintained to the extent only that it has not been dismissed. Attempts have been made to discover means of maintaining lively interest in matters pertaining to engineering features of civil defence, but even the most promising of these was abortive.

As the conditions under which your committee was appointed have changed and the purposes for which it was appointed have either been fulfilled or become unnecessary, your committee recommends that it be dismissed.

John E. Armstrong, m.e.i.c.,
Chairman.

COMMITTEE ON PROFESSIONAL INTERESTS

There has been ample evidence that during 1944 the co-operative agreements pursuant to By-law 78 between the Institute and the Associations in the provinces of Saskatchewan, Nova Scotia, New Brunswick and Alberta are all operating to the satisfaction of all concerned.

In December, the terms of a co-operative agreement between the Institute and the Corporation of Professional Engineers of Quebec was submitted to a vote, and approved by both parties. The corporate members of the Institute resident in the province of Quebec voted 697 for and 96 against; the members of the Corporation voted 765 for and 344 against. It is a matter of congratulation that the traditionally friendly relationship between the Institute and the Corporation will now be formalized.

With regard to the relations between the Institute and sister engineering societies—Canadian, British and American, there has been little definitive progress during the year in effecting co-operative agreements pursuant to By-Law 82. Revision of the agreement between The American Society of Mechanical Engineers and the Institute, signed in Toronto on October 1st 1943, is still under discussion with officers of the Ontario Section of the Society. Informal exploratory discussions are still under way between the chairmen of the Committee on Professional Interests and of the special committee appointed by the president of the American Institute of Electrical Engineers in 1943 to consider ways and means for promoting closer relations between the two societies. While discussions with other sister societies are in the preliminary stage only, they are very promising.

Mention should be made of an invitation to participate in a meeting in London, England, on August 28th, to discuss the possibility and advisability of establishing an international federation of engineering institutions and societies. The Institute was represented at the meeting by W. O. Maclaren, m.e.i.c., of the Ministry of Works. The latest word received on this project is that a provisional organization committee was appointed to survey the situation in order to discover if there was enough interest on the part of existing engineering organizations to justify the contemplated federation.

At the request of Council, the committee has given careful consideration during the year to several proposals emanating from members of other engineering societies for some all-embracing organization that could speak for all branches of the engineering and certain other professions in Canada. There has been complete unanimity among the members of the committee, in their inability to recommend any of the proposals. An attempt, however, is being made to evolve, for the consideration of Council, a set of principles which will set out very plainly the policy and the programme of the Institute with regard to co-operation among the members in Canada of Canadian, British and American engineering societies.

Dr. Challies having requested relief from the responsibilities of chairman of the Committee on Professional Interests, the undersigned has, at the urgent request of the president and with the approval of the Council, accepted this duty. At the same time, the committee had been reorganized to make it geographically representative. It is now constituted as follows:

Col. W. G. Swan	Vancouver, B.C.
James A. Vance	Woodstock, Ont.
G. J. Currie	Halifax, N.S.
Dr. J. B. Challies	Montreal, Que.
G. A. Gaherty	Montreal, Que.
J. E. Armstrong	Montreal, Que.
Dean A. Circe	Montreal, Que.
J. B. Stirling	Montreal, Que.

Respectfully submitted,

J. B. Stirling, m.e.i.c., *Chairman.*

PAPERS COMMITTEE

The Papers Committee reports a rather inactive year. A special film for branch circulation showing the activities of engineers in the active services was ordered from the Public Relations Office of the Department of National Defence, but it was found to be quite unsuitable for the purpose. Further efforts to secure a suitable film have been of no avail, although the committee still feels that the right material is in Canada if only it could be edited and put together into one or more reels.

The Committee notes that branches have secured papers of a high standard covering a wide range of subjects. It believes that an increased appropriation for expenses, including speakers for branch meetings, would be very helpful, particularly to the smaller branches, but appreciates the difficulty of securing such funds out of present revenues.

The general secretary and Headquarters staff have been of great assistance, particularly by keeping branches informed of additions to the film library.

Respectfully submitted,

L. F. Grant, m.e.i.c., *Chairman.*

COMMITTEE ON DETERIORATION OF CONCRETE STRUCTURES

The committee has no report to make for this year. It has purposely been inactive feeling that, while there is plenty of work for it to do, it would be desirable to wait until more favourable times when its members could give it proper attention.

I have discussed this with several of its members who concur in this view and I think are prepared, when the war in Europe is over, to undertake the programme of work which we have had in mind for some time.

Respectfully submitted,

R. B. Young, m.e.i.c.,
Chairman.

KEEFER MEDAL COMMITTEE

The Keefer Medal Committee consisting of Messrs. R. L. Hearn, A. C. D. Blanchard and E. P. Muntz unanimously recommends that the first award of this medal should be made to M. V. Sauer, M.E.I.C., for his paper entitled "St. Lawrence River Control and Remedial Dams — Soulanges Section". This paper was presented before the Montreal Branch on October 7, 1943, and was published in *The Engineering Journal* in December, 1943.

Thirteen papers in all have been reviewed before arriving at the above recommendation.

As chairman of the committee, I wish to record my appreciation of the cooperation given by Messrs. Hearn and Blanchard which has resulted in the unanimous opinion given above within two weeks of the assignment being given to the committee.

I presume that this report terminates the work of this committee and I therefore presume that the committee may be dissolved.

Respectfully submitted,

E. P. MUNTZ, M.E.I.C., *Chairman.*

ROSS MEDAL COMMITTEE

Your committee, which has been appointed to adjudicate the papers on electrical subjects presented to the Institute during the season 1943 to 1944, has for examination the following papers:

(1) Electrical Systems in Military Explosive Plants, presented January 20, 1944, by J. R. Auld, M.E.I.C.

(2) Electrical Equipment at Shipshaw, presented March 9, 1944, by R. A. H. Hayes, M.E.I.C.

Both papers dealt in a descriptive form with installations of plant and equipment with which the authors were associated as part of an organization charged with the work of designing and engineering the respective projects.

The decision of your committee therefore rested on the value and extent of enginering information presented and on the appropriate selection and inclusion of items of engineering interest.

On this basis, the committee unanimously recommends the award to R. A. H. Hayes for his paper on "The Electrical Equipment at Shipshaw".

Respectfully submitted,

E. V. LEIPOLDT, M.E.I.C., *Chairman.*

PLUMMER MEDAL COMMITTEE

It is the unanimous opinion of the members of your committee that the Plummer Medal for 1944 should be awarded to Wilfred Gallay for his paper "Plastics in Engineering" as published in the February, 1944, issue of the *Journal.*

Respectfully submitted,

PAUL E. GAGNON, M.E.I.C., *Chairman.*

LEONARD MEDAL COMMITTEE

Your committee is of the opinion that the Leonard Medal for 1944 should be awarded to J. E. Gill and P. E. Auger for their paper "Zinc Deposits in the Federal Area" as published in the December, 1943, 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 1944, the special committee consisting of Past-Presidents C. J. Mackenzie, C. R. Young 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 1944 are being awarded to:

Edward Phillips Fetherstonhaugh, Lieut. Col., M.C., B.Sc., Dean of the Faculty of Engineering and Architecture, University of Manitoba, Winnipeg, Manitoba.

John Armistead Wilson, Director of Air Services, Department of Transport, Ottawa, Ontario.

Respectfully submitted,

DE GASPÉ BEAUBIEN, 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 December 16th 1944, and the following awards were made:

John Galbraith Prize (Province of Ontario), to A. A. Hershfield, S.E.I.C., for his paper "Plywood: A Structural Material for Aircraft."

Ernest Marceau Prize (Province of Quebec—French), to André Leclerc, S.E.I.C., for his paper "Influence de la vitesse d'essai sur la résistance".

Martin Murphy Prize (Maritime Provinces), to J. L. Belyea, S.E.I.C., for his paper "The Cathode Ray Oscillograph and its Applications in Industry."

GZOWSKI MEDAL COMMITTEE

It is the unanimous recommendation of your committee that the Gzowski Medal for the year 1944 be awarded to Walter Griesbach, M.E.I.C., for his paper "Construction of Shipshaw No. 2 Power Development" as published in the April 1944 issue of the *Journal.*

Respectfully submitted,

T. H. JENKINS, M.E.I.C., *Chairman.*

DUGGAN MEDAL AND PRIZE COMMITTEE

Your committee has examined carefully the papers presented to the Institute during the prize year and is of the opinion that none of them is of sufficient merit to justify an award of the Duggan Medal and Prize.

Respectfully submitted,

W. J. W. REID, M.E.I.C., *Chairman.*

CANADIAN LUMBERMEN'S ASSOCIATION PRIZE

Your Committee has considered the papers eligible for the Canadian Lumbermen's Association Prize during the prize year and recommends that the first award of this prize be made to Professor C. F. Morrison of the University of Toronto for his paper "Modern Timber Engineering" which appeared in the October 1943 issue of *The Engineering Journal.*

Respectfully submitted,

JOHN L. LANG, M.E.I.C., *Chairman.*

Abstracts of Reports from Branches

Note—For Membership and Financial Statements see pages 94 and 95

BORDER CITIES BRANCH

The Executive Committee held nine meetings during the year for the transaction of branch business.

Nine Branch meetings were held during the year including the annual meeting and the visit of our president, Mr. de Gaspé Beaubien. Information about these meetings is as follows, attendance being shown in brackets:

Jan. 14—**Your Fire Department,** by Clarence J. DeFields, chief of the Windsor Fire Department. (24.)

Feb. 18—**Infra-Red Applications in Industry,** by P. Thompson, illumination manager of Toronto District, Northern Electric Company, Limited. (35.)

Mar. 17—**Erection of the Rainbow Bridge,** by E. L. Durkee, resident engineer for the Bethlehem Steel Company. (62.)

Apr. 14—**The Ogoki Diversion,** by J. R. Montague, assistant hydraulic engineer, Hydro-Electric Power Commission of Ontario. (51.)

May 20—**Description of the Polymer Steam and Power Plant,** by F. F. Walsh, combustion engineer, St. Clair Processing Corporation. This paper was presented at Sarnia. (101.)

June 14—Special meeting on the occasion of the president's visit. The president, Mr. de Gaspé Beaubien, spoke on **Canada's Industrial Effort as It Affects the Engineer.** Dr. L. A. Wright, general secretary of the Institute spoke on matters affecting the general membership and Mr. R. E. Heartz spoke on Collective Bargaining for Engineers. (60.)

Oct. 20—**Giving Wings to Words—To-day and To-morrow,** by George Long, historian of the Bell Telephone Company of Canada—illustrated by demonstration of equipment. (38.)

Nov. 17—**Engineering in National Defence—The Combustion Turbine,** by Major G. G. M. Carr-Harris, Deputy Assistant Director of Tanks and Military Trucks, Inspection Board of United Kingdom and Canada. (44.)

Dec. 8—Annual meeting and election of officers. A paper on **Magnesium Aircraft Wheels** was given by J. G. Hoba, assistant chief engineer, Kelsey Wheel Company Limited. (26.)

CALGARY BRANCH

During the year the Branch Executive met seven times.

The following report covers the activities of the Branch for the year 1944:

Jan. 13—**History of Exploration in the Canadian Rockies,** by Dr. H. H. Beach. (52.)

Jan. 27—**The Electronic Microscope,** by C. K. Chisholm. (65.)

Feb. 10—**Waterworks Systems of Alberta and Some of Their Attendant Problems,** by D. B. Menzies. (52.)

Feb. 24—**The Alaska Highway,** by Major General W. W. Foster. (124.)

Mar. 11—Annual Meeting, followed by Dinner. (42.)

Mar. 23—**The Operations of the Alberta Nitrogen Products Co.,** by D. D. Morris (68.)

Oct. 24—Dinner Meeting, followed by President's Address. (148.)

Nov. 2—**Coal and Coal Mining,** by H. Wilton Clarke. (61.)

Nov. 16—**Air Transportation,** by J. Moar. (34.)

CAPE BRETON BRANCH

On April 26th President de Gaspé Beaubien visited the Branch. He was accompanied by General Secretary L. A. Wright and Councillor R. E. Heartz. The presidential party had luncheon with the officers of the branch and other prominent engineers at the Cove. In the afternoon a trip was made through the rolling mills and that evening there was a dinner meeting which combined the annual meeting of the branch and the reception to the president. The dinner started under the chairmanship of J. A. MacLeod, the retiring chairman, who handed over during the course of the programme to M. F. Cossitt, the new chairman of the branch.

The following morning the party was taken to visit some of the power plants of the Dominion Steel & Coal Company, returning at noon to have luncheon with the officers of the branch. In the afternoon the party divided, some visiting the naval base and others taking in points of interest having to do with National Defence.

EDMONTON BRANCH

During the year the Branch held eight general meetings and, in addition, two meetings were held in conjunction with other societies. The following is a summary of our regular meetings with attendances shown in brackets. All of these meetings were preceded by an informal dinner.

Jan. 6—**Water Resources Systems of Alberta with Some of Their Attendant Problems,** by D. B. Menzies, Provincial Sanitary Engineer. (47.)

Jan. 25—Film on **The Electron Microscope**—R.C.A. Victor, by K. C. Chisholm of the staff of the R.C.A. Victor Company. Members of the Association of the Professional Engineers of Alberta, Canadian Institute of Mining and Metallurgy, and the Academy of Medicine were among those invited. (150.)

Mar. 7—**Military Strategy in the Northwest,** by Major General W. W. Foster, C.M.G., D.S.O., V.D. (80.)

Apr. 5—This was the discussion of a memorandum by Dean Young of the University of Toronto re the **Establishment of Institutes of Technology.** Paper read by Dean R. S. L. Wilson, University of Alberta, and general discussion followed. (31.)

May 9—**Air Transportation,** by J. Moar, head of Planning and Production Department of Aircraft Repair Limited. (34.)

Oct. 20—Banquet in honour of President de Gaspé Beaubien and party. Addresses by Mr. Beaubien, Mr. R. A. Heartz, and Dr. L. Austin Wright. (117.)

Nov. 14—**The Operations of the Alberta Nitrogen Products Co.,** Calgary, by D. D. Morris, general manager of the Alberta Nitrogen Products. (36.)

Dec. 2—Joint meeting with Association of Professional Engineers and Canadian Institute of Mining and Metallurgy. The dinner was followed by an address by G. M. Blackstock, Chairman of the Board of Public Utility Commissioners. (69.)

HALIFAX BRANCH

During the year meetings were held as follows:

Jan. 20—Combined annual banquet at Nova Scotian Hotel. (232.)

Feb. 24—W. S. Wilson, chief engineer, Dominion Steel and Coal Corporation, spoke on **The History, Operation, Development and Post-War Plans** of the above company. (72.)

Mar. 23—Dr. N. W. McLeod, Imperial Oil Company, Toronto spoke on **The Place of Soil Engineering in Post-War Highway Construction.** (82.)

Apr. 21—The Branch was host to President De Gaspé Beaubien and his party consisting of G. L. Dickson, R. E. Heartz and L. Austin Wright, general secretary. There were also present as guests of the Branch, Premier A. S. MacMillan, Air Vice-Marshal G. O. Johnson, Rear Admiral L. W. Murray, Commander D. W. Piers and J. E. Lloyd, Mayor of Halifax. (150.)

Oct. 19—Captain Berton E. Robinson, associate editor of The Halifax Chronicle, addressed the meeting on the subject, **The Gateway of the North.** On the completion of this talk, William Stairs, Son & Morrow showed a sound film on the **Construction of the Alaskan Highway.** (105.)

Nov. 23—John T. Farmer, M.E.I.C., mechanical engineer of the Montreal Engineering Company, Limited, and J. W. MacDonald of the Nova Scotia Light and Power Company, Limited, addressed the meeting and showed slides of the new 12,500 kilowatt Steam Electric Station construction in Halifax for the Nova Scotia Light and Power Company, Limited. The meeting also had a conducted tour through the new plant. (135.)

HAMILTON BRANCH

The Branch has had a very active year. Very excellent work has been done by the Students' Papers and Prize Committee under the chairmanship of E. G. Wyckoff with A. R. Hannaford and A. H. Wingfield as members. Another committee with C. H. Hutton as chairman and T. S. Glover has headed up the Branch activities with regard to Collective Bargaining. A third committee with T. S. Glover as Chairman and A. H. Wingfield has represented the Branch in the Institute's work in Ontario with regard to the formation of Technical Institutes.

The Branch wishes to record in this report our thanks to Chancellor Gilmour for the continued use of the facilities of McMaster University.

The Executive Committee of the Hamilton Branch held eight meetings during the year with an average attendance of eight members.

During the year the Branch held the following meetings with the attendance figures as given in the brackets:

Jan. 7—The Annual Meeting and Dinner was held in the Scottish Rite Club, the guest speaker being Wing-Commander T. R. Louden, who spoke on the subject, **Aviation, Past, Present and Future.** (100.)

Feb. 17—**Stone Canyon** and **Oil for War,** two colour films with sound, by the Barrett Company Ltd., of Montreal, with discussion by D. McLaren of the same Company. (85.)

Mar. 23—Students' Night. **The Economical Use of Power Hack Saw Blades,** by J. C. Buchanan, S.E.I.C., and **Electronics as Applied to Spot Welding,** by K. R. Knights, S.E.I.C. Atlas Steels Limited presented their film, **Vision Fulfilled.** (48.)

Apr. 14—Annual joint meeting with the Toronto Section, A.I.E.E. The subject was **Future Power Opportunities,** by A. C. Monteith, manager of Industry Engineering, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., U.S.A. (190.)

May 11—**The Engineering History of Shipshaw,** by McNeely DuBose, vice-president of the Aluminum Company of Canada, Limited. (120.)

June 12—A special dinner meeting was held to honour President de Gaspé Beaubien, C.B.E., who gave a very delightful talk on the affairs of the Institute and of the engineer. Also present were R. E. Heartz, chairman of the Institute's Committee on Employment Conditions, who outlined the work of his Committee with reference to P.C. 1003 and Collective Bargaining; and Dr. L. Austin Wright, general secretary, who drew attention to the efforts of the Institute to obtain adequate recognition for the engineer in the Armed Services. (86.)

July 3—Special Meeting on **Collective Bargaining.** The discussion was lead by C. H. Hutton, and T. S. Glover. (46.)

Sept. 28—**Progress of Science in Criminal Investigation,** by V. A. M. Kemp, Assistant Commissioner and Director of Criminal Investigation, Royal Canadian Mounted Police, Ottawa. (75.)

Oct. 17—Joint meeting with the American Institute of Electrical Engineers, Hamilton Subsection. **The Decew Falls Development—Past and Present,** by Dr. Otto Holden, chief hydraulic engineer of the Hydro-Electric Power Commission of Ontario. (115.)

Nov. 16—Ladies' Night. The Branch entertained the ladies at a very successful dinner meeting at the Scottish Rite Club. The speaker was Dr. Samuel G. Hibben, Director of Applied Lighting, Lamp Division, Westinghouse Electric and Manufacturing Company Ltd., East Pittsburgh, U.S.A., whose subject was **How Illuminants Are Born.** (180.)

Dec. 14—**The Welding and Fabrication of Canadian Light Armour,** by F. J. McMulkin, Ontario Research Foundation, Toronto.

KINGSTON BRANCH

During the year the following meetings were held by the Branch:

Jan. 11—**Evolution of the Steam Engine,** by Prof. D. M. Jemmett, head of Electrical Engineering Dept., Queen's University.

Jan. 26—**Plastics,** by V. T. Griffiths, plastics engineer, Canadian General Electric Co. Ltd.

Feb. 8—**Nylon in War and Peace,** by C. J. Warrington, development manager, Nylon Division, Canadian Industries Limited.

Feb. 22—Student Night. **Engineering Uses of Some Unknown Metals,** by A. R. Bader (1st prize); **Fire Protection in a Small Factory,** by C. E. Leon (2nd prize); **Industrial and Economic Aspects of Plastics,** by K. Rothchild (2nd prize).

Mar. 7—**Town Planning and the Future of Kingston,** a symposium; public meeting. A. S. Mathers, Toronto; W. Cecil Cole, Kingston; Prof. R. A. Low, Kingston.

Apr. 25—Annual Meeting, with films: **Tested by Underwriters Laboratories, The Failure of the Tacoma Narrows Bridge,** and **Wings Over the North.**

Sept. 16—Dinner meeting, Cataraqui Golf Club, Kingston. Visiting members of Council and their wives entertained by the Branch.

Oct. 18—**The Magic of Electric Welding,** by P. H. Take, welding engineer, Canadian General Electric Co.

Nov. 1—Brig. J. Melville, M.C., E.D., Chairman, The Canadian Pensions Commission: **Plans for the Rehabilitation of Our Armed Forces.** A public meeting.

Nov. 15—**The Engineering History of Shipshaw,** by McNeely DuBose, vice-president, Aluminum Company of Canada. An open meeting.

Dec. 6—Student Night. **Alloys, the Backbone of Chemical Engineering,** by A. Bader (1st prize); **Concrete Inspection,** by R. McKnight (2nd prize).

LAKEHEAD BRANCH

The Branch held the following meetings during the year:

Jan. 19—Fort William. **Television and Frequency Modulation,** accompanied by coloured sound films, by J. Murie, branch manager, Canadian General Electric Company. (31.)

Feb. 22—Port Arthur. Annual dance, Prince Arthur Hotel. (130.)

Mar. 22—Fort William. Visit to Canadian Car and Foundry Company Plant after short descriptive talks by members of the Plant personnel, A. D. Norton, P. H. Spence, J. I. Carmichael, Canadian Car and Foundry Company. (46.)

Apr. 12—Port Arthur. **Powder Metallurgy,** accompanied by sound film, by J. Murie, branch manager, C.G.E. (22.)

May 10—Port Arthur. Visit to Port Arthur Shipbuilding Company, after descriptive talks relative to Aircraft Department and shipyards by O. M. Gunderson and H. Walton. (60.)

June 16—Port Arthur. Annual Meeting and election of officers. (33.)

Oct. 12—Port Arthur. Special meeting on the occasion of the visit of President de Gaspé Beaubien and General Secretary L. A. Wright. (27.)

Oct. 13—Atikokan, Ontario. Branch Visit to Steep Rock Iron Mines. M. S. Fotheringham, manager, Steep Rock Iron Mines. (40.)

Nov. 10—Fort William. **Steep Rock Iron Mine—Its General Features and Power Supply,** accompanied by coloured motion pictures and slides, by A. H. Frampton, assistant chief electrical engineer, Hydro-Electric Power Commission of Ontario. (36.)

Dec. 15—Port Arthur. **Post-war Reconstruction,** by Honourable C. D. Howe, Department of Munitions and Supply. (50.)
Town Planning, by J. Murchison.

LETHBRIDGE BRANCH

The Branch held the following meetings during the year:

Jan. 14—A corporate members meeting was held dealing mainly with the election of officers and proposals for the year's activities.

Mar. 23—A regular meeting was held in the Y.M.C.A. The speaker was Mr. L. Jacobson and his subject was **The Wheat Stem Saw Fly.**

Mar. 25—The annual combined meeting of the Lethbridge Branch of the Engineering Institute of Canada and the Professional Engineers of Alberta was held in the Marquis Hotel. The guest speaker was Lt. Leckie of the U.S. Engineering Division, Edmonton, and his subject was **The Finishing of the Alaska Highway.** (62.)

Apr. 21—A regular meeting was held for the purpose of discussing Dean Young's paper on the **Establishment of Technical Institutes in Canada for the Returning Servicemen.**

June 2—A regular meeting was held to further discuss Dean Young's paper and draw up resolutions to be sent to the proper authorities.

Oct. 27—A special meeting was called on the occasion of the President's annual visit. The guest speaker was President de Gaspé Beaubien and he dealt with **Engineer's Contributions to Canada's War Effort.**

Nov. 24—The guest speaker was D. F. Hamelin who gave a paper entitled **Development of Sub-Surface Water in Alberta—A Post-war Project.**

Dec. 15—**Ecological Engineering,** accompanied by a movie entitled **The Big Marsh Lives Again,** by T. C. Main.

LONDON BRANCH

During the year, the Executive held 6 business meetings, and 10 regular and special meetings.

Jan. 12—Annual meeting and election of officers. **Ducks Unlimited,** by Geo. N. Fansett.

Feb. 16—Sound Colour films **Oil for War** and **Stone Canyon,** by D. McLaren, engineer of the Barrett Co. Ltd.

Mar. 8—General discussion on branch activities.

May 17—**Town Planning in London,** by R. W. Garrett, city engineer, London.

June 13—Special dinner meeting for the president, Mr. de Gaspé Beaubien.

Sept. 29—Open discussion on **Thames River Valley Development** led by R. W. Smith, and **Technical Institutes** explained by H. F. Bennett.

Oct. 25—Open discussion on **Collective Bargaining.**

Nov. 22—Open discussion on Revision of Branch By-laws.

Dec. 13—Report on the **Muskingum Conservancy District,** by W. R. Smith, county engineer.

MONTREAL BRANCH

The Executive Committee held nine regular meetings during the year. The Annual Meeting of the Branch was held on January 27th, at which time the President of the Institute, Mr. K. M. Cameron, paid his official visit and addressed the members. Special meetings of the Branch were called on July 20th to discuss Collective Bargaining and the Engineer and on October 26th to elect the Branch Nominating Committee.

The programme of meetings continued to be excellent and the average attendance of 139 compared to 140 last year indicates no falling off of interest. The social evening held on February 24th proved to be more popular than ever as it was noted that the attendance increased by 50 over the preceding year.

Without doubt, the most outstanding achievement of the year was the successful conclusion of the work undertaken three years ago by the Branch Committee on Provincial Professional Interests. As everyone knows, the Proposed Agreement between the Engineering Institute and the Corporation of Professional Engineers of Quebec has been accepted by the vote of the membership of both parties. Great credit is due to the untiring efforts of Mr. J. A. Lalonde, to the members of his committee and others who so willingly helped.

Following is the list of meetings held during the year, with attendance shown in brackets:

Jan. 13—**The Manouan and Passe Dangereuse Water Storage Developments,** by F. L. Lawton. (160.)

Jan. 19—**Electric Systems in Military Explosive Plants,** by J. R. Auld. (80.)

Jan. 27—Annual Meeting of the Branch. (80.)

Feb. 3—**Some Wartime Applications of Refrigeration,** by Dr. W. H. Cook. (80.)

Feb. 10—**Everyday Electronics,** by John Mills. (160.)

Feb. 17—**Future Products for the Chemical Industry,** by H. H. Lank. (150.)

Feb. 24—Annual Social Evening. (250.)

Mar. 2—**Construction of Shipshaw Development,** by Walter Griesbach. (225.)

Mar. 9—**Electrical Equipment at Shipshaw,** by R. A. H. Hayes. (130.)

Mar. 16—**Highway Expenditure vs Highway Investment,** by J. O. Martineau. (60.)

Mar. 23—**Intercepting Sewers in Quebec City,** by J. G. Chenevert. (55.)

Mar. 30—**Network Radio Operation,** by Dr. Augustin Frigon. (130.)

Apr. 5—**Canadian Engineering Standards Association,** by Col. W. R. McCaffrey and W. J. Cale. (60.)

Apr. 13—**New Materials of Engineering with Special Reference to Gas Turbines,** by F. Nagler. (130.)

Apr. 20—**Design of Large A.C. Generators with Specific Reference to Accessibility for Inspection and Repair,** by H. R. Sills. (100.)

Apr. 27—**Meteorological Services for Utility Systems,** by A. E. Davison. (100.)

July 20—Special Meeting to discuss **Collective Bargaining and the Engineer.** (250.)

Oct. 5—Opening Night; films. (285.)

Oct. 12—**Methods and Practical Value of Soil Classification,** by Dr. Karl Terzaghi. (180.)

Oct. 21—Visit to United Shipyards (Bickerdike Basin). (200.)

Oct. 28—Visit to Shipyards (Bickerdike Basin). (125.)

Oct. 26—**Field Decay Characteristics of Large Hydro-Electric Generators,** by J. T. Madill. (80.)

Nov. 2—**Industrial Relations—Human Engineering,** by E. R. Complin. (175.)

Nov. 9—**The Burning of Solid Fuels,** by Otto de Lorenzi. (185.)

Nov. 16—**The City Manager Plan,** by Jean Asselin. (80.)

Nov. 23—**Ball-Bearings,** by H. Little. (150.)

Nov. 30—**Giving Wings to Words To-day and To-morrow,** by George L. Long. (130.)

Dec. 7—Annual Student Night. (155.)

Dec. 14—**Development of Water Wheel A.C. Generators,** by C. M. Laffoon, (85.)

Junior Section

While the presentation of papers was still one of the main activities of the Junior Section, great strides were made this year towards increased usefulness to the young engineer. The widespread interest in collective bargaining (with its special importance to the younger engineer) and other aspects of engineering as a profession brought about the formation of a committee on the welfare of the young engineer. The purpose of this committee is to foster discussion groups which will eventually form the basis of open forums.

The phenomenal expansion of Canadian industry has been accompanied by an increased need for technical knowledge which, in some instances, is of advanced character. To assist those who might be interested in perfecting their knowledge of any particular engineering subject, a committee on the development of the young engineer has been formed. This committee has made a survey of existing evening study facilities in the region. A questionnaire has been sent out to the membership in order to ascertain their needs. Acting on the replies to the questionnaire, courses were organized in calculus, engineering materials, and soil mechanics.

A third committee was named to study means of increasing the interest of the students in the activities of the section. Visits to both Ecole Polytechnique and McGill University are scheduled for early in the new year. This will give students of both universities the opportunity to increase their "professional" association.

A discussion group on Electronics, meeting fortnightly, has been sponsored jointly with the Institute of Radio Engineers.

Branches	Border Cities	Calgary	Cape Breton	Edmonton	Halifax	Hamilton	Kingston	Lakehead	Lethbridge	London
MEMBERSHIP										
Resident										
Hon. Members	..	..	..	..	..	..	2	..	..	..
Members	56	103	30	72	194	101	50	32	18	25
Juniors	8	11	4	17	14	16	11	3	1	1
Students	8	6	4	28	50	23	91	8	1	1
Affiliates	1	1	1	1	1	1	1	7	..	2
Total	73	121	39	118	259	141	155	50	20	29
Non-Resident										
Hon. Members	..	..	..	..	..	..	..	..	..	..
Members	24	17	25	11	76	21	4	14	17	14
Juniors	7	4	5	3	8	2	5	4	7	1
Students	9	3	13	11	18	5	7	3	11	4
Affiliates	..	..	2	..	..	1	..	..	..	1
Total	40	24	45	25	102	29	16	21	35	20
Grand Total December 31st, 1944	113	145	84	143	361	170	171	71	55	49
" December 31st, 1943	104	138	71	133	327	158	83	62	56	43
Branch Affiliates, December 31st, 1944	..	43	..	..	..	14	..	..	..	..
FINANCIAL STATEMENTS										
Balance as of December 31st, 1943	295.21	322.77	567.97	168.01	405.30	215.93	130.32	245.23	251.86	34.01
Income										
Rebates from Institute Headquarters	242.70	67.92	65.30	62.40	78.07	302.04	114.28	120.65	34.05	92.26
Payments by Professional Assns.	..	241.70	109.35	202.83	424.80	..	..	..	53.60	..
Branch Affiliate Dues	..	125.00	..	..	..	45.00	..	..	..	..
Interest	4.00	15.56	..	..	0.98	60.24	..	3.18	0.97	3.00
Miscellaneous	455.80	..	39.00	..	32.07	8.00	8.15	317.50	22.83	243.00
Total Income	702.50	450.18	213.65	265.23	535.92	415.28	122.43	441.33	111.45	338.26
Disbursements										
Printing, Notices, Postage①	44.04	61.21	27.10	75.54	124.51	121.60	73.49	38.78	28.78	20.85
General Meeting Expense②	486.00	85.98	2.00	33.10	112.07	..	8.25	240.00	28.85	7.00
Special Meeting Expense③	..	190.25	78.03	124.18	120.25	128.18	32.80	167.33	70.85	111.65
Honorarium for Secretary	..	22.80	..	50.00	50.00	..	..	10.00	..	..
Stenographic Services	10.00	10.00	..	22.50	40.35	50.00	21.50	5.10	3.00	..
Travelling Expenses④	..	18.25	2.08	17.95	..	62.45	16.45	..	..	..
Subscriptions to other organizations	..	..	..	..	..	..	..	..	..	..
Subscriptions to *The Journal*	..	36.45	..	..	..	8.30	..	..	2.00	..
Special Expenses	55.98	..	..	..	91.78	..	34.11	13.50	4.00	6.00
Miscellaneous	..	30.25	..	..	36.56	52.83	3.57	2.37	5.59	47.35
Total Disbursements	596.02	455.19	109.21	323.27	575.52	423.36	190.17	477.08	143.07	192.85
Surplus or *Deficit*	106.48	*5.01*	104.44	*58.04*	*39.60*	*8.08*	*67.74*	*35.75*	*31.62*	145.41
Balance as of December 31, 1944	401.69	217.76	672.41	109.97	365.70	207.85	62.58	209.48	220.24	179.42

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.

F THE BRANCHES AS AT DECEMBER 31, 1944

Moncton	Montreal	Niagara Peninsula	Ottawa	Peterborough	Quebec	Saguenay	Saint John	St. Maurice Valley	Saskatchewan	Sault Ste. Marie	Toronto	Vancouver	Victoria	Winnipeg
..	2	..	1	1	..	..	..	..	..	..	1	..	1	6
42	914	72	339	40	107	51	45	44	69	22	436	147	43	124
4	183	16	59	19	15	16	5	16	7	5	81	11	4	27
24	623	12	79	7	7	20	17	16	4	1	109	48	8	71
..	25	1	6	..	2	2	3	1	..	..	13	..	1	3
74	1747	101	484	67	131	89	70	77	80	28	640	206	57	231
..	..	..	..	..	..	..	..	..	..	..	..	1	..	2
16	50	5	77	16	15	3	50	2	65	30	18	41	6	21
7	24	..	20	2	3	1	4	2	12	3	7	5	2	6
10	50	..	43	4	7	..	45	8	69	3	8	12	2	6
..	1	..	4	2	1	1	1	2	1	..	1	1	..	..
33	125	5	144	24	26	5	100	14	147	36	34	60	10	35
107	1872*	106	628	91	177	94	170	91	227	64	674	266	67	266
72	1613	106	590	93	153	104	147	90	204	64	633	222	54	266
4	13	7	22	9	..	..	..	..	..	14	..	1	..	9

*For voting purposes only, there should be added to Montreal Branch, an additional 307 members, 188 being resident in the United ates, 88 in British possessions and 34 in foreign countries.

41.63	2,145.63	260.76	1,333.96	257.95	126.00	233.31	277.46	107.04	16.64	529.23	818.00	355.90	109.12	549.94
36.70	2,317.01	202.86	707.57	181.91	286.77	207.30	41.55	148.63	9.60	125.75	819.14	318.01	112.17	294.98
05.00	..	..	..	..	..	..	156.00	..	288.57	7.53	..	..	..	..
17.50	53.00	29.40	42.00	24.00	..	..	6.00	..	..	30.00	..	..	3.00	45.00
3.46	26.40	5.50	40.77	1.05	0.72	..	..	..	..	15.13	13.52	1.26	..	26.00
32.25	100.45	..	25.00	1.55	226.47	45.00	5.00	..	..	145.15	57.62	..	109.70	69.36
94.91	2,496.86	237.76	815.34	208.51	513.96	252.30	208.55	148.63	298.17	323.56	890.28	319.27	224.87	435.34
28.77	1,012.45	51.07	116.40	70.07	116.06	34.10	51.96	32.19	19.94	50.56	260.92	101.83	20.50	124.43
25.00	93.00	29.78	20.00	43.75	27.15	63.84	15.85	59.87	141.98	..	36.70	45.00	10.50	10.80
68.75	260.16	46.87	172.60	46.41	22.68	142.56	24.15	..	..	199.55	38.68	123.55	146.08	22.61
25.00	300.00	100.00	..	..	100.00	..	25.00	..	60.00	37.50	100.00	50.00	35.00	75.00
10.00	120.00	5.00	50.00	..	..	..	10.00	5.00	12.00	..	40.00	20.00	..	..
7.67	54.67	13.35	..	..	..	..	..	..	49.33	..	6.30	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7.15	26.00	10.18	12.00	6.00	..	..	2.00	..	..	24.00	..	..	..	16.50
..	220.71	2.70	680.00	..	..	..	6.83	0.30	..	..	155.00	..	..	349.50
3.83	63.99	..	87.29	6.00	14.40	20.17	2.34	..	5.32	4.57	191.40	6.50	4.00	20.52
176.17	2,150.98	258.90	1,138.29	172.23	280.29	260.67	138.13	97.36	288.57	316.18	829.00	346.88	216.08	619.36
18.74	345.88	*21.14*	*322.95*	36.28	233.67	*8.37*	70.42	51.27	9.60	7.38	61.28	*27.61*	8.79	*184.02*
160.37	2,491.51	239.62	1,011.01	294.23	359.67	224.94	347.88	158.31	26.24	536.61	879.28	328.29	117.91	365.92

The following is a list of Junior Section meetings:

Feb. 28—Annual Meeting. Mr. de Gaspé Beaubien spoke on **The Engineer in the Community.**

Mar. 20—Open forum on activities of the section. Dr. L. Austin Wright addressed the members and a sound film was presented.

Mar. 27—Visit to Canadian Vickers Ltd., Aircraft Division, Cartierville. (250.)

Apr. 17—**Quality Control at Canadian Propellers Ltd.,** by Maurice Conklin, and **Modern Trends in Mechanical Engineering,** by Raymond A. Frigon.

July 27—**The Young Engineer and Collective Bargaining,** by R. E. Heartz.

Oct. 3—Opening Meeting. C. C. Lindsay, Chairman of the Montreal Branch, addressed the members. Albert Clément, chairman of the Junior Section Committee on the Welfare of the Young Engineer, spoke on **Collective Bargaining,** and Raymond A. Frigon, Provisional Chairman of the Junior Section Committee on the Development of the Young Engineer, spoke on **Educational Facilities for Recent Graduates.**

Nov. 13—Film Night.

Dec. 7—Annual Student Night. **The Development of Power at Back River,** by G. H. Y. Slader (McGill); **Analysis of True Unit Stress of Copper,** by Denis Noiseux (Polytechnique); **The Realization of a Dream,** by P. J. Robinson (McGill); **Design of an Explosion-Proof Concrete Wall,** by Louis A. Dion (Polytechnique). (155.)

MONCTON BRANCH

The Executive Committee held seven meetings. Ten meetings of the Branch were held as follows:

Feb. 22—A dinner meeting was held in the Brunswick Hotel. H. Franklin Ryan, Canadian General Electric Co., gave an address on **Electronics.**

Mar. 28—A meeting was held in the city hall, when a series of technicolor films, dealing with concrete highway construction, were shown.

Mar. 30—A combined meeting of Moncton Branch and the Engineering Society of Mount Allison was held in the Science Building of the University. Films on concrete highway construction were shown.

Apr. 17—A dinner meeting was held in the Y.M.C.A. in honour of the President of The Engineering Institute of Canada, Mr. de Gaspé Beaubien.

May 11—A meeting was held in the city hall for the purpose of nominating branch officers for the year 1944-45.

May 29—Annual meeting.

July 24—A. D. Ross, a member of the Institute Committee on Employment Conditions, led a discussion on **Collective Bargaining for Engineers.**

Oct. 12—The executives of the Moncton Branch of the Engineering Institute of Canada, the Moncton Board of Trade, the Junior Chamber of Commerce, together with members of the City Council met in the City Hall. J. S. Galbraith of the National Housing Administration delivered an illustrated address on **Community Planning.**

Dec. 4—A meeting was held in the city hall. Two films were shown, the first dealing with photo-flash photography, and the second with the manufacture of electric light bulbs.

Dec. 5—A joint meeting of Moncton Branch and the Engineering Society of Mount Allison was held at the University at Sackville. Films on photo-flash photography and electric light bulb manufacture were shown.

NIAGARA PENINSULA BRANCH

The branch executive held one electoral and six business meetings during the year.

The programme committee arranged for and conducted the following general professional meetings:

Jan. 20—Dinner meeting held at the Leonard Hotel, St. Catharines. The speaker was Dr. H. G. Acres, who gave an illustrated lecture on **A General Description of the Shipshaw Development.**

Feb. 24—Dinner meeting at the General Brock Hotel, Niagara Falls. The guest speaker was J. D. Willis, of the Canadian General Electric Company, who gave a lecture on **Electronics in Industry,** and also presented a movie on **Sightseeing at Home.**

Mar. 23—Joint dinner meeting with the Niagara Falls, N.Y., section of the American Institute of Electrical Engineers. The dinner was held at the General Brock Hotel, Niagara Falls, Ont., and the speaker was E. W. Henderson, of the English Electric Co., who addressed the meeting on **The Application of Synchronous Condensers for Effective Control of Circuits Affected by Arc Furnaces.**

Apr. 27—Dinner meeting and ladies' night, held at the Leonard Hotel, St. Catharines. The evening speaker was R. W. Emery, who gave an illustrated talk on **Impressions of Trinidad and British Guiana.** Many samples of native work and woods were displayed.

June 15—Branch annual dinner meeting, held at the Park Restaurant, Niagara Falls, through the courtesy of the Victoria Park Commission. The president, Mr. de Gaspé Beaubien, the general secretary, Dr. L. Austin Wright, and Mr. R. E. Heartz, all of Montreal, were our guests and addressed the meeting on professional and E.I.C. affairs.

July 28—Special dinner meeting held at the Leonard Hotel, St. Catharines, to discuss **Collective Bargaining.** The meeting was first addressed by Messrs. C. G. Moon, J. W. Brooks, and W. D. Brownlee, who spoke on three different aspects of the subject. The meeting was then thrown open for extended discussion.

Oct. 26—Dinner meeting held at the General Brock Hotel, Niagara Falls. Guest speaker was O. G. Moffat, of the Canadian Westinghouse Company. The subject of the meeting was **Air Sanitation,** with particular reference to the use of the Precipitron.

Nov. 16—Dinner meeting held at the Leonard Hotel, St. Catharines. The speaker was A. H. Frampton, of the Hydro-Electric Commission of Ontario, who spoke on the development and construction of **The Steep Rock Iron Mine.**

OTTAWA BRANCH

The following meetings were held during the year, the attendance being shown in brackets:

Jan. 13—Annual evening meeting, auditorium, National Research Council. Showing of two films, **The Banff-Jasper Highway** and **The Story of Canadian Pine.** (80.)

Feb. 3—Luncheon meeting, Chateau Laurier. **Reconstruction and Re-Establishment,** by Hon. Gray Turgeon, M.P. (133.)

Feb. 24—Evening meeting, auditorium, National Research Council. **Electricity in Modern Warfare,** by G. E. Bourne, General Electric Company. (75.)

Mar. 9—Luncheon meeting, Chateau Laurier. Sound colour film, **Oil for War,** courtesy of the Barrett Co., Montreal. (132.)

Apr. 17—Joint evening meeting with the Illuminating Engineering Society, auditorium, National Museum. **The Engineer Looks Ahead,** by M. J. McHenry. (80.)

May 4—Evening meeting, auditorium, National Research Council. Sound colour film, **The Manufacture of Laminated Plastics,** courtesy of Arnold Banfield and Company, Toronto. (90.)

Oct. 12—Luncheon meeting, Chateau Laurier. Assistant Commissioner V. A. M. Kemp, R.C.M.P., spoke on **The Application of Science to Criminal Investigation.** (110.)

Nov. 9—Luncheon meeting, Chateau Laurier. Sound colour films, **Construction of Trans-Canada Highway,** courtesy of the Ontario Department of Highways, with commentary supplied by the chairman. (110.)

PETERBOROUGH BRANCH

The following meetings were held during the year, with attendance shown in brackets:

Jan. 13—**Reaction Type Hydraulic Turbine Design,** by C. G. Southmayd of Canadian Allis Chalmers Co. (39.)

Feb. 5—Social Evening (Ladies Night).

Feb. 17—**Nylon in War and Peace,** by C. J. Warrington of Canadian Industries Ltd. (36.)

Mar. 2—**Technique of Testing High Voltage Bushings,** by G. W. N. Fitzgerald of H.E.P.C. of Ontario. (22.)

Mar. 16—Junior and Student Night. **Design and Manufacture of Alnico Magnets,** by D. L. Cole; **Cosmic Rays,** by G. M. Nixon. (37.)

Mar. 30—**Blue Reels Turning,** by M. J. Aykroyd, Bell Telephone Company. (44.)
May 16—Annual business meeting.
June 24—Annual picnic.
Sept. 14—**Big Inch Pipe Line,** by D. McLaren of The Barrett Company. (62.)
Sept. 21—Joint Meeting with Association of Professional Engineers of Ontario. **Collective Bargaining,** by T. M. Medland. (45.)
Nov. 2—**The Wrought Copper Alloys,** by G. S. Mallett of Anaconda American Brass Ltd. (30.)
Dec. 6—Annual Dinner. President de Gaspé Beaubien was guest speaker. (63.)

QUEBEC BRANCH

The executive committee held six meetings with an average attendance of eight members. The programme of activities was as follows, attendance being given in brackets:

Jan. 24—**Controlled Illumination for Perfection and Comfort,** by H. John Ward. (86.)
Feb. 28—**Oil for War** and **Stone Canyon**—films. (40.)
Mar. 6—Forum: Proposed agreement between the C.I.P.Q. and the E.I.C. (60.)
Mar. 13—**Projets d'après-guerre dans l'Industrie Electrique,** by Léo Roy, Quebec Power Co. (40.)
May 8—Annual Meeting of the branch. **La Physique Moderne et ses Applications,** by Dr. Franco Rasetti. (65.)
July 24—**The Engineer and Collective Bargaining,** by Gerald Martin. (30.)
Aug. 28—Annual golf tournament. (75.)
Nov. 6—**Rayons Cosmiques,** by Dr. Franco Rasetti. (53.)
Nov. 13—**The Magic of the Spectrum,** by Marcel Laflamme, Canadian General Electric Co. (133.)
Dec. 4—**Ressources Humaines du Québec,** by Huet Massue, Shawinigan Water & Power Co. (51.)
Dec. 18—S.H. le maire de Québec, Monsieur Lucien Borne, on **Projets d'après-guerre pour la Cité de Québec.**

SAGUENAY BRANCH

During the year a total of 18 general meetings were held as follows:

Jan. 19—**Lubrication,** by F. Moody, manager, industrial sales department, Imperial Oil Co. Ltd., Montreal, Que. Two films: **The Inside Story of Lubric; The Portland-Montreal Pipe Line.**
Feb. 3—**The Manouan and Passe Dangereuse Water Storage Developments,** by F. L. Lawton, Aluminum Company of Canada, Ltd., Montreal, Que.
Feb. 16—**Developments of Steam Production at Arvida,** illustrated with slides, by M. G. Saunders, Aluminum Company of Canada, Ltd., Arvida, Que.
Feb. 23—**Plastics,** by A. E. Byrne, manager, Plastic section supply department, Canadian General Electric Company, Toronto, Ont.
Mar. 1—**The Engineering History of the Shipshaw,** by McNeely DuBose, vice-president, Aluminum Company of Canada, Ltd., Arvida, Que.
Mar. 8—**The Combustion Turbine,** by A. Leuthold, chief engineer, Swiss Electric Company of Canada, Ltd., Montreal, Que.
Apr. 12—**A Description of the Electrical Equipment at Shipshaw,** by R. A. H. Hayes, acting chief engineer, Aluminum Laboratories Ltd., Montreal, Que.
Apr. 19—**Some Aspects of Automatic Control,** by W. F. Steinkamp, assistant sales manager, Brown Instrument Div. Minneapolis-Honeywell Regulator Co. Ltd., Montreal, Que.
May 10—**Geology and the Effect of Water,** by W. C. Gussow, Aluminum Company of Canada, Ltd., Shipshaw, Que.
June 14—**The Engineer and His Profession,** by P. E. Poitras, The Steel Company of Canada, Ltd.
June 23—**Welding in Industrial Maintenance,** by H. Thomasson, metallurgical engineer, Canadian Westinghouse Company, Ltd., Hamilton, Ont.
July 2—**Collective Bargaining.** J. N. Martin, Dominion Bridge Company, Montreal, Que., led the meeting. (Special meeting to discuss the different aspects of collective bargaining as it may affect the engineer.)
Aug. 3—Dinner meeting held in the Saguenay Inn Grill, for the purpose of meeting the Institute president, Mr. de Gaspé Beaubien, and the general secretary, Dr. L. Austin Wright.
Sept. 13—**General Considerations Governing the Use of Aluminum,** by G. R. Black, general technical dept., Aluminum Company of Canada, Ltd., Montreal, Que.
Sept. 28—**Oil for War,** a film depicting **The Big Inch** through courtesy of the Barrett Company, Montreal, Que.
Oct. 25—**Concrete at Shipshaw,** by W. F. Campbell, Roberval & Saguenay Railway Company, Arvida, Que., formerly concrete engineer, Aluminum Company of Canada, Ltd., Shipshaw, Que.
Nov. 21—**Proposed Agreement Between the Engineering Institute of Canada and the Corporation of the Professional Engineers of Quebec.** A special meeting called to discuss the various points of the above agreement. The discussion was led by J. Crawford, of Shawinigan Water & Power Co., Montreal, in the absence of J. A. Lalonde, of Montreal, Que.
Dec. 18—**Economics and the Post-war Application Thereof,** by A. L. Simcox, of Price Brothers & Company, Ltd., paper division, Kenogami, Que.

SAINT JOHN BRANCH

The executive held eight meetings with an average attendance of seven members. The executive gave special attention to the revision of the Branch by-laws.

Two special meetings of the Branch were arranged and five regular meetings as listed below with the attendance of the meetings given in brackets:

Jan. 26—Annual joint dinner with the Association of Professional Engineers of the Province of New Brunswick. Mr. G. H. Prince, Deputy Minister of the Department of Lands & Mines, addressed the members on **The Natural Resources of the Province.** (54.)
Feb. 24—The Atlas Steel Corp. film, **A Vision Fulfilled,** was shown at a dinner meeting. (18.)
Mar. 17—Dr. N. A. MacKenzie, President of the University of New Brunswick, addressed the Branch on **Canada and the Post-war World.** (43).
Apr. 18—Dinner, held in honour of Mr. de Gaspé Beaubien, President of the Institute. (46.)
July 17—Special meeting to hear an interim report by the general secretary, Dr. Austin L. Wright, on **Collective Bargaining.**
Sept. 14—Special meeting at which J. S. Galbraith, National Housing Administration, Ottawa, addressed the members on **Community Planning.**
Dec. 5—Address by Dr. Milton F. Gregg, V.C., president of the University of New Brunswick, on **The Engineer in Canadian Army** and **Problems Arising with Engineering Courses at the University.** (35.)

ST. MAURICE VALLEY BRANCH

Following is a list of the meetings which were held during the year, with the attendance as shown in brackets:

June 22—Dinner and annual meeting, with the installation of new officers, at the Cascade Inn, Shawinigan Falls. R. E. Heartz was the guest speaker and his topic for the evening was **Collective Bargaining and the Engineer.** (76.)
July 25—A meeting was held at which G. H. Martin led a forum on the subject of **Collective Bargaining.** The meeting was held at the Cascade Inn in Shawinigan Falls under the chairmanship of R. Dorion. (27.)
Aug. 15—Joint meeting with the Shawinigan Falls Chemical Association, under the direction of our branch chairman. W. M. Gifford of the Aluminum Company of Canada spoke on **Aluminum—Past, Present and Future.** Special films were shown on the manufacture of aluminum goods. (140.)
Sept. 27—Meeting of the members of the executive.
Dec. 12—Dinner and meeting at the Cascade Inn, Shawinigan Falls, to welcome President de Gaspé Beaubien and his party. During the afternoon, a visit was made to the Cellophane Plant of the Canadian Industries Ltd., by the president and his party, accompanied by branch officers. (48.)

SASKATCHEWAN BRANCH

All meetings were held jointly with the Association of Professional Engineers, the average attendance being 46. The respective programme were as follows:

Jan. 21—Regular meeting, addressed by K. G. Chisholm, B.E., on **The Electron Microscope.**

Feb. 18—Annual meeting, addressed by Rev. Harry Joyce, on **People I Have Met.**

Mar. 24—Regular meeting. **Forest Conservation in Canada,** by Robson Black, President, Canadian Forestry Association.

Oct. 18—Regular meeting, addressed by President de Gaspé Beaubien, on **Institute Affairs.**

Nov. 17—Regular meeting. **Education in the Services,** by E. F. Holliday, Secretary, Educational Committee, Canadian Legion War Services, Inc.

Dec. 18—Regular meeting, addressed by Hon. J. H. Brockelbank, Minister of Municipal Affairs, on **Municipal Affairs.**

SAULT STE. MARIE BRANCH

The executive committee of the Branch met three times during the year. Seven dinner meetings were held with an average attendance of 26 members and guests. The programmes were as follows:

Jan. 21—**Archaeology as an Engineer's Hobby,** by R. H. Merrill, post engineer, U.S. Army War Dept., Fort Brady, Sault Ste. Marie, Mich.

Feb. 25—**Structures in Steel,** by W. H. M. Laughlin, chief designing engineer, Ontario Division, Dominion Bridge Co. Ltd., Toronto.

Mar. 31—**Electronics in Industry,** by Mr. Becker, sales engineer, Canadian General Electric Co. Ltd.

TORONTO BRANCH

The executive held fifteen meetings with an average attendance of nine.

Regular meetings of the Branch are listed below, with the attendance given in brackets:

Jan. 7—Ladies Night. Joint meeting with the Junior Section. (172.)

Jan. 20—**Launching Ten Thousand Ton Cargo Vessels,** by P. G. A. Brault. (41.)

Jan. 26—**Engineering Features of the Toronto City Plan,** by S. R. Frost, N. D. Wilson, A. E. K. Bunnell, and A. S. Mathers. Visit to the Exhibition of the City Planning Board, Toronto. (140.)

Feb. 3—Dinner meeting. **The Ogoki Diversion,** by O. Holden. (86.)

Feb. 5—Joint meeting with the Royal Canadian Institute. **How Shall We Use Our Natural Resources,** by Dr. R. C. Wallace.

Feb. 17—Student Night. Joint meeting with the Junior Section and the University of Toronto Engineering Society. **Flood Control,** by D. H. Perkins; **Magnesium as an Aircraft Component,** by J. H. Ward; **Fluid Drives,** by E. M. Peacock; **Glass as a Structural Material,** by H. D. McNiven; **Air Jet Propulsion,** by J. Ward. (85.)

Mar. 2—Joint meeting with the American Institute of Electrical Engineers. **Design Features of the Shipshaw Development,** by Dr. H. G. Acres. (250.)

Mar. 16—**The Clarkson Oil Refinery,** by R. L. Rude. **Oil for War** (colour film). (91.)

Apr. 1—Annual meeting.

Oct. 5—**Transportation Subways,** by Charles E. De Leuw. (105.)

Oct. 19—**Trades Training,** by Col. W. H. Bonus, G. M. Gore and J. M. Piggot. (45.)

Oct. 24—Joint meeting with the American Society of Mechanical Engineers. **Rockets, Gas Turbines and Jet Propulsion,** by Dr. Lionel S. Marks. (600.)

Nov 16—Joint meeting with the Canadian Society of Forest Engineers. **Mechanization of Woodlands Operations,** by J. W. McNutt. (98.)

Nov. 30—Joint meeting with the Institute of Radio Engineers. **Radio for Over Land Long-Distance Telephone Service,** by S. T. Fisher. (105.)

Dec. 7—Dinner meeting. **Canada's Nitrogen Industry,** by S. R. Frost. (40.)

VANCOUVER BRANCH

The Branch held the following meetings during the year:

Jan. 17—**Fishway Problems in B.C. and Neighbouring Streams,** by John McHugh.

Feb. 3—**The Electron Microscope,** by K. G. Chisholm.

Feb. 23—Student Night. Chairman: V. L. Mosher. **The Aluminum Industry,** by Alan M. Eyre; **Lofting and Template Making for Airplane Parts,** by H. B. R. Graves; **Soil Stabilization,** by R. Scarisbrick.

Mar. 24—Meeting with ladies at Stanley Park pavilion. **The Romance of the North Country,** by C. E. Webb.

Apr. 3—Joint meeting with A.I.E.E. **Industrial Application of the Science of Metals,** by Frank Forward.

Apr. 24—**The Uses of Glass; Industrial, Structural and Ornamental,** by Dr. Gilbert Hooley.

May 26—**Power Development of the Skagit River by the City of Seattle,** by E. R. Hoffman.

Oct. 4—**Hell's Gate Fish Ladders,** by Milo Bell.

Nov. 3—Dinner meeting. **Institute Affairs:** De Gaspé Beaubien, L. Austin Wright and R. E. Heartz.

Nov. 3—Tea for Ladies at Shaughnessy Golf Course.

VICTORIA BRANCH

During the year there were four meetings of the executive committee and five general meetings of the branch. The branch meetings may be summarized as follows:

Jan. 15—Lecture meeting. **Flying Control and Air-Sea Rescue Work** by Squadron Leader R. M. Donaldson and Flight Lieutenant G. H. Lee. This meeting was held under the joint auspices of the Oak Bay A. R. P. organization and the Victoria Branch, E.I.C. In addition the air cadets of the greater Victoria High School were in attendance. There were a total of about 500 people present. The talk was accompanied by a film entitled **Prepare for Ditching.**

Feb. 1—Lecture meeting. **Into Unseen Worlds,** by K. G. Chisholm, sales engineer of R.C.A. Victor of Winnipeg, Man. The talk was illustrated by a film entitled **Into Unseen Worlds** and by slides. Attendance was 60.

Aug. 2—General discussion meeting. **Collective bargaining and the Engineer.** This meeting was held in the Oak Bay municipal hall to discuss the subject of collective bargaining. Attendance was 12.

Nov. 5—General meeting. This meeting was called to hear President de Gaspé Beaubien, General Secretary L. A. Wright, and Mr. Heartz, chairman of the Institute Committee on Employment Conditions.

Nov. 6—President's visit. A dinner meeting was held at the Empress hotel in honour of the visit of the presidential party. About 55 members and their ladies were present. Mr. Beaubien gave a very inspiring address concerning the place of the engineer in the Canadian scene.

WINNIPEG BRANCH

The following Branch meetings were held during the year:

Jan. 6—Dr. J. Ansel Anderson, chief chemist, Board of Grain Commissioners for Canada, Winnipeg, spoke on **Engineering Aspects of Agricultural Development.**

Jan. 10—Dinner in honour of W. P. Brereton, retiring city engineer.

Feb. 3—Annual meeting of the Branch. Following the business of the meeting, two films were shown—**A Modern Aladdin's Lamp** and **Mining Above Ground.**

Mar. 2—K. G. Chisholm, R.C.A. Victor Co. Ltd., spoke on **The Electron Microscope.**

Apr. 6—F/L N. M. Fowler, R.C.A.F., gave an address on **The Application of Aerial Photography to Survey Work.**

Sept. 28—G. R. Pritchard, Canadian General Electric Co., spoke on **The Magic of the Spectrum,** or **Illumination.**

Oct. 17—On this day the Branch was honoured to have as guests, President de Gaspé Beaubien, L. Austin Wright, general secretary, and R. E. Heartz, councillor, at a luncheon meeting held in the Hudson's Bay Co. dining room.

Dec. 7—Lawrence J. Green gave an interesting address on **Town Planning.**

DEFENDANT'S FACTUM

Argument of Attorney for Engineer

District of Montreal No. 209929: Superior Court: The Province of Quebec Association of Architects, Plaintiff vs. Brian R. Perry, Defendant.

The case of the architects' association versus the engineer is so interesting and the judgment so serious to the profession and so far reaching that the complete text of the argument for the defence is reproduced herewith. By reading this, one can understand why the defendant expected a favourable decision, and why it has been decided to appeal the case. Unfortunately the written argument presented by the attorney for the plaintiff was approximately ten times as long as this argument of the defendant and therefore is too long to be reproduced.

Additional reference to the case and the judgment is made in the Month to Month section of this issue.—*Ed.*

The Plaintiff Association complains that the Defendant has acted as an Architect "inasmuch as for remuneration he prepared and furnished sketches, drawings, plans and measurements, gave counsel and advice, and prepared and furnished specifications, called for tenders and arranged contracts for, and for remuneration supervised the construction of a building for and the property of Harrington Tool & Die Co. Limited at Lachine."

The Defendant answers that he is a member in good standing of the Corporation of Professional Engineers of Quebec, and was such at all the times mentioned in the complaint, and that the acts complained of form part of the activities of a Civil Engineer as defined by statute.

The Plaintiff Association was incorporated by 54 Victoria, Chapter 59, assented to on the 30th day of December 1890. This Act and the amendments thereto, prior to the amendment of 1929 reserved nothing to the members but the exclusive right to use the name or title "registered Architect" or "Architect."

It was only by the amendment 19, George V, Chapter 67, assented to on the 4th of April 1929, that the paragraph set out in the second allegation of Plaintiff's declaration was added. At the same time and by the same amendment act which added the said paragraph recited in Plaintiff's declaration, a further paragraph was added which reads: "Nothing in this section shall be interpreted as affecting in any manner whatsoever the rights and privileges conferred by law upon the members of the Corporation of Professional Engineers of Quebec." Both of these amended sections now appear as part of section 12 of Chapter 272 of the Revised Statutes of Quebec 1941.

Members of the Corporation of Professional Engineers of Quebec were granted by 61 Victoria, Chapter 32 (Que.) assented to the 15th of January 1898, the exclusive right to use the title of "Civil Engineer," and to act and practise as Civil Engineers within the meaning of the first section of the Act, Sub-paragraph (d) of which reads:

"The expression 'civil engineer' means any one who acts or practises as an engineer in advising on, in making measurements for, or in laying out, designing or supervising the construction of railways, metallic bridges, wooden bridges, the cost of which exceeds six hundred dollars, public highways, requiring engineering knowledge and experience, roads, canals, harbours, river improvements, light houses, and hydraulic, municipal, electrical, mechanical, or other engineering works, not including government colonization roads or ordinary roads in rural municipalities; but it is not deemed to apply to a mere skilled artisan or workman."

This section is now sub-section 4 of section 2 of Chapter 270 of the Revised Statutes of Quebec 1941, and for the purpose of this argument is exactly the same as originally enacted.

It was held in the case of Association des Architectes de la Province de Québec vs. Ruddick, 59 K.B. page 72, that an action under the Architects' Act to recover a fine is a penal action, and that the statute in that respect is a penal statute, because it imposes a penalty or punishment, and as such it must be restrictively construed in favour of the person charged with the offence.

Our first submission is that the rights given to Engineers by the Statute of 1898 were not disturbed or interfered with to the slightest extent by any amendment to the Architects' Act.

Any burden of proof that may at the outset have rested upon the Defendant was removed and placed upon the Plaintiff so soon as the Defendant proved his membership in the Corporation of Engineers, and that buildings formed part of the activities enumerated in sub-section 4.

The Defendant proved both of those points, and was assisted in respect to the second point by the declaration made on behalf of the Plaintiff that it did not intend to contest same. Thereupon and thereafter the burden rested upon the Plaintiff to establish that the building in question in this lawsuit did not form part of the enumerated engineers' activities.

The Plaintiff, instead of attempting to make such proof or to contradict the evidence offered by the Defendant, confined its efforts to an attempt to prove the capacity of architects to make plans and specifications for the building in question.

Our second contention is that irrespective of where the burden of proof lies, that the defendant has conclusively established that he has not gone outside the sphere of activities exclusively falling within the province of Engineers.

We respectfully submit that what the Defendant did, will be found to fall within the expression "mechanical or other engineering works." A machine shop is surely a mechanical works. It is full of mechanical machines and it can hardly be anything other than a mechanical work, and a machine shop ordinarily does not consist of machines only, there must be some sort of a building and usually the building is more than a single storey.

It is essential that the building be designed and laid out for the efficient working of the machines to be operated in it. It is not necessary that the designer of the building be a designer of the machines in order that the work be a mechanical one. The illustration offered at the argument, we submit, stands good—one engineer may design and lay out a power house and another engineer may design and lay out the dam, while a third or several other engineers may design the machinery. All are part or parcel of the same work. In the same way a machine shop building is part and parcel of the machine shop. The machinery in the machine shop is no less unique to the machine shop than is the machinery in the power plant. Certain of the equipment that was much framed into the Harrington building, for example the tempering or heat treatment equipment as the power equipment in a power plant. It is true that the machine shop is not complete without a building. A building is not an accessory to a machine shop, it is, we submit, fundamental. To operate, the machines must be housed.

Our third contention is that the machine shop in question had to be particularly constructed for the proper functioning of the machines to be operated therein, because to operate the Harrington machines at all satisfactorily, they had to be subject to a minimum of vibration and a minimum of temperature change. These were engineering problems as well as mechanical problems, they were problems that had to be determined in advance of, and before the building could be detailed, and they controlled also the design of the building.

In support of our contention we wish to cite from the evidence of Mr. James M. Robertson commencing at the bottom of page 108 and continuing onto page 109.

Q. On what do you base your opinion that it is engineering work ?

A. The designer of a project of this kind must when he takes on the job, first study the problem that is set before him: that is, he has to consider the material which is to be manufactured, the degree of precision which is to be attained, the various factors which may be unfavourable and may work against his producing such precision work at the rate that is asked for as well as the favourable conditions; and out of all these studies he must evolve a design which will in his opinion take care of all these problems to the maximum extent. That is all done before he starts to make any drawings at all; that is the engineering study; that is the main backbone of the whole thing. After all of those factors are determined, the putting of those determined factors into a physical entity such as a building is a small matter. That is nothing; anybody can do it. But anybody cannot do that first thing.

A question arose at the oral argument, whether a mechanical work to fall within sub-section 4 must also be an engineering work.

The answer to this question, we submit, is that upon the true construction of the sub-section, mechanical works are declared to be engineering works. In this respect we submit that the French version of sub-section 4 is clearer than the English version. The English version reads:

> "Hydraulic, electrical, mechanical, municipal or other engineering works."

Whereas the French version reads:

> "Travaux hydrauliques, électriques, mécaniques, municipaux et autres travaux d'ingénieur."

Our fourth contention is that the argument put forward by Counsel for Plaintiff to the effect that architects have the exclusive right to prepare plans and specifications for buildings, and engineers the exclusive right in respect of engineering works is subject to some modification, seeing that it was conceded at the trial and at the argument that "works" includes buildings.

The contention then should read, "architects have the exclusive right to make plans and specifications to construct or remodel buildings, except such buildings as are comprised in the "works,"in respect to which Engineers have been given exclusive jurisdiction.

With this modification the contention that Architects may make plans and specifications for buildings and Engineers may construct works is not decisive of the issue. Again Engineers are not limited to construction, they may lay out and design. It is not necessary that they construct. The word "construction" used in subsection 4 applies only to the word "supervise."

Our fifth contention is that it is unnecessary for the decision in this case to reconcile the provisions of the Architects' Act with those of the Engineers' Act, because the rights given to the Architects were made subsidiary to the rights given to the Engineers. Now, if it should be that the new rights given to the architects in 1929 are illusory, the position of Architects was not made any worse than it was before the amendment.

Having said that, we may add that we do not contend that the Architects' rights are illusory, they have the sole right to make plans and specifications to construct or remodel buildings, except such buildings as the Engineers have the sole right to lay out and design, and this, we submit, means that the architects' exclusive right applies to all buildings not forming part of one or other of the activities enumerated in said sub-section 4. But, however that may be, the point we submit is that the rights granted to Engineers in 1898 are not cut down in the slightest degree by the rights granted to the Architects in 1929.

Our sixth contention is that as all the features in this particular job belong to the engineering class, and the end to be achieved was a mechanical one, it follows that the ensemble belongs to the mechanical and engineering classes. If each feature of the work is examined separately, it will be found to be an engineering feature. For instance the supports and columns, beams, floors and roof were of reinforced concrete. Now, the overwhelming testimony in this case is that reinforced concrete for structural purposes is designed by engineers. The plumbing and heating is also an engineering job.

In the Jetté case, Jetté was charged with having made plans for a heating system and thereby having contravened with the provisions of the Engineers' Act. The first Court and the Court of Appeals exonerated Jetté on the ground that he came within the exception contained in subsection 4, as he was a mere skilled artisan or workman. In that case, it was said that Architects are rarely experts in heating. The evidence, therefore, must have agreed with the evidence made in the present casê. Electricity was required for power and lighting; elevators were also required. Both these jobs were engineering jobs.

We remind the Court that Mr. Payne, who was the architect in charge of the construction of the Sun Life Building, testified that engineers designed and specified for the foundation of that building, the structure, the electricity for power and lighting, the plumbing and heating, the roof, the elevators and the power plant, and when asked what was left for the architects, he said "The finishing."

Messrs. Pitts and Perrault alone testified that they designed and specified for the above items. Both these gentlemen had engineering training. In rebuttal the Defendant proved that even Mr. Pitts applied to an Engineer to design and specify for the dome of a church, and that in at least two cases, Mr. Perrault had the design and specifications for structural reinforced concrete made by an Engineer. The buildings were the Rockland Garage and the Crescent Building. It has been urged against this argument, that if a church can be constructed of reinforced concrete, it would become an engineering work. Our reply to that is, it may be necessary to look at the work as a whole, and not at one or two features only of it, and if this were done in

(*Continued on page 78*)

From Month to Month

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

ROUND ONE GOES TO THE ARCHITECTS !

According to the Honourable Mr. Justice O. S. Tyndale of the Superior Court, Montreal, "in general only a member of the Plaintiff Association can legally 'furnish for remuneration plans or specifications to construct or remodel a building' ", the "plaintiff association" being the Province of Quebec Association of Architects which some time ago took action against an engineer for making plans to construct a certain machine shop in the province of Quebec. Accordingly, Mr. Tyndale found the defendant guilty of having violated the architects' Act.

This revealing decision was handed down on January 26th, 1945. It will come as a shock to engineers throughout Canada who believe that since the development of the industrial age, industrial buildings were the work of the engineer. Many hundreds of engineers and employers may well look back on the era of crime which this judgment establishes for them, and look forward to the "arrangements" they will have to make in the future to continue the sane and well established policy of having industrial buildings designed by engineers.

This interpretation of the Acts of the engineers and the architects in the province, if it is allowed to stand, will have a seriously detrimental effect upon the practice of engineering. The judgment not only finds the engineer guilty of having contravened the architects' Act on this particular building, but denies him the right to design any building "such as the one in question in this case." As no other building will be identical, it is evident that this phrase will be considered by the architects' association as encouragement to take legal action on a wide range of structures, including almost anything that could be considered a building.

It is a disturbing thought to an engineer that if argument such as that put forward in this case by the architects convinces the court that an engineer may not design a shop for making precision tools, it may well be used to prove that he may not design buildings for power development, a pulp and paper plant, a concentrator, and so on. To an engineer, all of these buildings, as well as a machine shop, have always been distinctly his field. The basic engineering understanding and requirements as applied to the building itself which determined its layout and design details, are probably far more precise and technical in this instance than in most instances; therefore, if the technical aspects are not clear enough for a court in this case, they would hardly be in any other. Are we then to face a period in which, for example, pulp and paper mills will become the work of architects ?

The Defence

Elsewhere in this *Journal* is the argument or "factum" as prepared for the Court by the attorneys for the engineer. A perusal of this will make clear to the reader the sound basis upon which the defence was conducted, but will confuse and confound him when he considers the judgment. It will also bring a realization of the desirability, if not the necessity, of appealing the case and of revising the Act. If in the face of such sound reasoning an engineer may still be denied the right to continue to design industrial buildings it is apparent that in the public interest something must be done. The *Journal* is informed that already notice of appeal has been filed.

The Court's Difficulty

There is no denying that the case was a difficult one. The judge stated that the admissions of the various facts, with the Plaintiff's early formal proof, constituted a "prima facie" case for the architects. Doubtless he made a sincere and valiant effort to understand the complexities of a technical field in which he was probably a stranger, so that he might make a fair and legally sound decision. Nevertheless, there are points in his judgment which do not make sense to an engineer.

In the first place the judge threw out all the evidence that was taken over several days, and states "The problem must therefore be solved by a comparison of the two texts in the light of the ordinary canons of interpretation and the argument of counsel." The defendant's plea rested entirely on the claim that the building in question was "a mechanical engineering works" as mentioned in the engineers' Act. To prove this, several expert witnesses were called so that the judge would have the necessary information before him, but this evidence was thrown out.

The judgment clearly infers that there is a restricted class of buildings that can be considered as "engineering works"; but if expert testimony is not admissible to prove that a building is in that class, how can this or any other defendant even attempt to prove his case ?

Again the judgment finally develops a new meaning for the word "works", (the word used in the Quebec Engineers' Act) which is difficult to accept. In this writer's opinion it cannot be substantiated by reference books or by custom and yet on that unique interpretation the whole adverse decision is based. Although granting that "works" are the clear and legitimate field of the engineers, the judge finds unsuitable all explanations or definitions of that word other than his own. He quotes one dictionary as defining works as "an architectural or an engineering structure, edifice" but he fails to consider that definition in his decision, or to recognize the overlapping fields of the two professions so clearly indicated in that definition, and so well known in the construction industry. He goes on to say "It is obvious that some of the specific items mentioned in Section 2 (of the Engineers' Act. Ed.) comprise a building of some sort as an accessory; but none of them, except 'lighthouses', could in the opinion of the undersigned, be considered 'in se' as 'buildings'." From there on he decides that any buildings envisaged in the word "works" must be *accessory* only, and the judgment denies the defendant's plea that this machine shop is a "mechanical works," because it was not merely an accessory to a larger project.

It goes further, for the judge in his "conclusions" establishes the necessity for the engineer designing a building to be "concerned" in the construction of the entire "work" of which his building is an accessory. Imagine making it a legal requirement that the highly skilled specialist engineer designing a turbine or a generator must be similarly skilled in the equally specialized engineering requirements of building design before he can interest himself or specify in any way the building to protect his "works"; or conversely it infers that the engineer, to be legally entitled to design the building, must also design the mechanical or electrical equipment that goes in it; i.e., he must be responsible for the whole "works."

As an example, reference was made to the building over the turbines and generators of an hydro-electric power development, which it was admitted would be the work of an engineer because it was "accessory only." To make such a statement is to say that one's heart or one's stomach is accessory only. It doesn't make sense. The power house building is just as essential to the power project as any other part, and the turbines and generators couldn't operate without it, and there wouldn't be any power. To accept such an interpretation of "works" is to shut out the engineers from a field of endeavour which has always been theirs. The "lack of clarity and precision" which the judge finds in the Acts is not dispelled by such interpretations. It is the well known intention that lies behind this suit that such work should be designed as in the past by engineers but must be carried out over the signature of an architect. In this way engineering would cease to be a profession.

Architects and Industrial Buildings

No doubt architects have handled many industrial or manufacturing buildings, and with profit to themselves. It is well known that in many of these cases, half or more of the building design work is done by engineers, and much of it is made available through the supply trade without cost to the architect. It is paid for by the owner as part of the building cost but is not supplied by the architect who is paid for the job. Under such a profitable and satisfactory arrangement from the architects' point of view, the owner's interest in an unbiased, economical and adequate design for those parts of the building may tend to disappear even if the technical ability to properly check such engineering design actually exists.

Obviously, one of the main points stressed and reiterated by the defense was not considered by the judge to be serious; that the engineering work in any project of this kind starts and continues on many and major considerations that establish the requirements, and finally concludes with a building; the building itself is minimized, not because it is an accessory, but because its design and detailing are almost automatic after the "engineering" fundamentals and requirements have been worked out. In this case, the owner, a particularly skilled, competent and well informed manufacturer, called as a witness by the architects for formal proofs, testified that he didn't know the size of the building, even closely, the floor loadings or the heating system. "I left those things to the engineer; that's what I hired him for." On the other hand, architects testified, claimed in their plea, and their attorney insisted in his written argument, that when industrial buildings are handled by architects, they depend on the owner to supply such details!

Much was made by plaintiff's attorney of two points, and the fundamental absurdness of the conclusions apparently was not appreciated by the court. It was contended, first, that as the plant in question could be emptied of its machinery and still remain a building, and be used for a variety of purposes, there was nothing special about its design. The answer to this is that churches, due to a simple shift in urban growth, have often been used as warehouses and stores. They cease to be churches even though they were so designed! In Canada, to-day, the government is remodelling two large ocean-going ships to be used as rest and recreation centres for troops. Does ship-building thereby become a building architect's job, just because some day some one may decide to tie a ship to a dock and use it for an hotel? Even lighthouses, which the court admits are an engineering work, are converted to residences from time to time. Should they therefore be considered an architect's work? Such conclusions would be absurd!

The second point was: In considering the question of vibration on which there was extended argument and discussion, due to its technical quality, plaintiff's counsel seriously contended that an engineer's ability to understand and arrange and dispose weight to counteract vibration was not only equalled but was far surpassed by the architect responsible for the Sun Life Building because it was bigger and immeasurably heavier. Adequacy and economy of design, which is the essence of engineering, was stressed in reply but was not appreciated by the court.

Amendments to Architects' Act

If an engineer may be allowed to have an opinion on a purely legal point, it would seem that the centre of the dispute in Quebec is the restrictive clause in the architects' Act which clearly retains to the engineer any rights he had prior to that Act. The engineers' Act, passed in 1920, describes engineering in exactly the same words used in the old Civil Engineers' Act of 1898. Plaintiff's written argument mis-states that "In 1890 the Architects were secured in their rights as the planners of buildings". The significant paragraph of their Act was granted only in 1929. There, for the first time, is there any mention whatever of buildings. And in the same amending paragraph is the exception or saving clause in favour of engineers which reads, "Nothing in this section shall be interpreted as affecting in any manner whatsoever the rights and privileges conferred by law upon the members of the Corporation of Professional Engineers of Quebec". The judge properly states the first fact but omits reference to the second. Neither does he face the fact that these two related clauses are the only two significant changes made in that Act at that time. Surely a saving clause in such context should not be ignored but should be given ample consideration before elimination in a judgment well recognized as a test case.

Professional Ethics and Conduct

To show the ethical level at which the architects' case was handled, the *Journal* quotes a few extracts from the written argument as presented to the judge by attorney for the plaintiff:

> "The plea is shameful and invidious—a condemnation of an entire profession, without exception, by a man wholly unqualified either to belong to it or to criticize it."
>
> "Let the consulting engineer, like Perry, specializing in concrete or in electrical work, or other specialty, stay in his field as a consultant—let him wait until he is consulted by the architect or others."
>
> "If a few engineers and big contracting firms can get the contract on their own terms, draw the plans and specifications, furnish some semblance of architectural service, and do the work in their own way, without the co-ordinating and integrating planning and supervision of an architect, the intent of the statute is flouted. The fees and the work of architects go to engineers and contractors, and the architect is ignored."
>
> "Even an engineer, so verbosely sure of himself as Mr. Perry, or so interested as Mr. Chadwick, Mr.

McCrory or Mr. Stirling, would do well as witnesses under oath to keep on the persuasive side of the ridiculous." (Whatever that means.—Ed.)

The *Journal* has maintained from the beginning that the whole business was a useless and disgraceful exhibition. These quotations seem to offer no reason to change that opinion.

Other Interesting Quotations

The following additional excerpts from the plaintiff's argument may come as a surprise to engineers and to owners of buildings:

> "It is recognized that the architect is master, that he must exercise his judgment over the work done by engineers."
>
> "Section 12 of the Architects' Act grants architects a monopoly in respect of 'buildings'."
>
> "And, as was fully proved, architects have to deal with the placing, spacing, laying out and powering of machines in industrial, utility and processing buildings of many kinds, in planning and specifying them for the functional purposes of their owners."

It is unlikely that future developments made necessary by this decision will add any lustre to either profession, but it can be proven readily that the engineers' organizations have made attempts early and often to settle this dispute privately. The architects' association declined to negotiate outside of the courts, and so we come to to-day's situation, which may well be a long way from the end.

Because of the many architects in Quebec who do not support the action of the Association, the *Journal* regrets the necessity of attacking the judgment and the tactics of the Association. It is unfortunate that the whole profession has to suffer for the acts of what the *Journal* understands is a small group, but the engineers must defend themselves and their obligations to the public.

REHABILITATION OF MEMBERS

On the employment page of this issue is an advertisement stating that the Institute desires to secure the full time services of a member to take charge of the programme for assisting members in uniform at the time of their demobilization. This addition to the staff has been authorized by Council after long consideration, and after consultation with many persons interested in post war planning.

Council believes that returning members are entitled to every assistance that the Institute can provide. It is emphasized that it is not intended to have the service overlap or conflict with any existing service such as the Wartime Bureau of Technical Personnel, but rather to augment and amplify the recognized usefulness of such organizations to the members.

There will be another task also for the employment service of the Institute. This is related to the transfer of engineers from war industry to peace industry. Many members will be in this shuffle and additional assistance will certainly be required, if the Institute is to meet its obligations.

Members who are interested in work of this kind and in this opportunity are invited to communicate with Headquarters just as quickly as possible. The position is open now and the demand for the service is increasing.

"THE FAITH OF AN ENGINEER"

With this issue of the *Journal*, members will have received a copy of "The Faith of an Engineer." It is not the purpose of these lines to refer specifically to the Faith, as that has been well done on the leaflet itself, but rather to make acknowledgment of the Institute's indebtedness to the donors, the five past-presidents who have been privileged to represent the Institute on the Engineers' Council for Professional Development.

This gesture of support of the ethics of the profession will be of substantial assistance in developing and sustaining the professional mentality which is so essential to all professions. Members will join the officers of the Institute in thanking the past-presidents who have made this message available to the membership and to friends of the Institute.

RUSSIAN ENGINEERS VISIT INSTITUTE

Five Soviet construction engineers visited Headquarters on January 23rd. Their mission in Canada was to study winter construction methods, and their call at the Institute was to secure additional advice on persons and places that should be seen.

Heading the delegation was P. P. Novojilov, a member of the Purchasing Commission of the Soviet Union in the United States, and chairman of the standing technical committee on Industrial Rehabilitation. Other members of the group were I. Onufriev, recipient of the coveted Red Star, A. Khraskovsky, Y. Alikhanov and S. Levin.

All five gentlemen had seen recent service with the Russian forces, and wore service ribbons. It is doubtful if their average age exceeded thirty-five. They explained that they had seen some very interesting construction projects, although in many instances the work was completed before their visit. One member of the Institute, who conducted them over part of their tour in Montreal, said that they were particularly interested in concrete, and were quite surprised at the quantities produced by concrete plants on large projects. In Russia, their production per mixer was much lower.

From Montreal the group went to Toronto for a similar inspection but returned to Montreal the following week for an additional two days, after which they entrained for New York.

C.S.A. WELDING STANDARDS

The Institute's representative on the C.S.A. Committee, C. R. Whittemore, has submitted the following progress report on this subject:

I wish to report that a meeting of the Sectional Committee on Welding Standards was held at the Royal York on Friday, January 26th.

At this meeting it was agreed to bring up to date the Code S47T-1938—Tentative Welding Qualification Code for Fabricators, Contractors, Supervisors and Welders and S48T-1938—Metallic Arc Welding Electrodes for Iron and Steel.

Codes S59-1940—Metallic Arc Welding (Buildings and Bridges) and W-91 Proposed Specification—Welding of Mechanical Details are to be combined into one specification.

This work is to proceed without undue delay and it was the opinion of all Members that this action would bring about full acceptance of welding in building fabrication.

COLLECTIVE BARGAINING PROBLEM REACHES NEW STAGE

There is no definite progress to report on this subject since it was last commented upon in the *Journal*, but there has been some action about which the membership should be informed.

On January 9th, the Wartime Labour Relations Board (National) held an open hearing in Ottawa relative to the request of engineers and other professional workers for a separate order-in-council to establish and control collective bargaining for themselves. The previously appointed sub-committee of Messrs. MacRae, Dobson, and Heartz, spoke for the fourteen societies, and presented the brief which has been printed in the January issue of *The Engineering Journal*. The president and the general secretary were present as observers.

The hearing lasted all day, and the greater portion of it was taken up by certain organizations that were in opposition to the engineers' proposal. These included four well-established trade union groups and one recently established small group of professional workers. It would be unfortunate if this latter group's support of the trade unions' protest should have given the impression that the professional workers were divided in their opinions. However, their speaker admitted he represented but a few persons, and a study of their brief indicates that they had missed entirely the main points of the issue.

The experience of sitting through the hearing was a bit of an education. It provided a picture of democracy at work. Every one was heard, usually at great length, but without interruption, even though in many instances the observations were entirely irrelevant. Four speakers in opposition each consumed from a half hour to over an hour arguing points which were never an issue. In the vernacular, they seemed to be "shadow boxing".

Apparently the impression was abroad that the fourteen societies were going to base their case on the interpretation of the words "engaged in a confidential capacity" as written into the present order No. 1003. Each of the four opposition speakers laboured the point that professional workers should not be denied the privilege of collective bargaining by being classed as working in "a confidential capacity". However, no plea for exclusion on this basis was made by the committee, either verbally or in the brief.

The second point argued by the opposition was that the societies asking for the new legislation were not proper persons to appear before the Board or to attempt collective bargaining for professional workers, because in their membership they included employers as well as employees. The fact that the brief had pointed out and the chairman of the committee had emphasized specially, that it was not proposed that the societies should do collective bargaining, but that a new body made up only of employees was to be established for the purpose, seemed to be lost on the opposition. The brief reads:

> "In particular we should say, with reference to the professional employees' bargaining agency, it is intended that it be composed only of employees who are functioning in a professional capacity. It is not intended that it should contain any person who is in fact in the position of an employer. Accordingly there is no difference between us and others who have raised a question on this point."

The continued harping on these two irrelevant points by those who opposed the application left one with the impression that there were no real arguments against it. In fact, it is likely that unprejudiced listeners were convinced of the justice and right of the professional workers' case, as much by what the opposition said as by the brief itself.

The Canadian Manufacturers' Association presented a brief opposing the proposed legislation, but asking instead that professional workers be excluded permanently from the present order.

The Canadian Congress of Labour brief stated:

> "Our position in this matter springs from principle, the principle that every man or woman who works for a livelihood in this country has an unqualified right, a right without reservation to have a voice in the determining of his or her mode of livelihood, to determine that by the accepted agency of collective bargaining."

As each society had obtained an overwhelming majority vote from its members favouring collective bargaining by other than a trade union, it would seem that they had already used their voice to determine their own bargaining agency. They had said clearly that they did not want a trade union. On the ballot less than 1% voted for bargaining by a trade union.

The lawyer speaking for the Association of Technical Employees (C.I.O.) opened with the statement "I represent some people who are most concerned with the issue before the Board." Subsequently in response to an enquiry from a Board member as to how many graduate engineers were members of the organization, the secretary replied, "I am sorry I cannot tell you that offhand." It would have been interesting to know how many of the "persons most concerned" were professional workers, as it might have given some light on the A.T.E.'s interest in the issue. Their argument, like the others, though more voluble, was almost entirely on "confidential capacity" and the presence of employers in the membership of the societies. It took twenty-one foolscap pages of the stenographer's notes to record it all!

The Trades and Labour Congress representative's argument was no more convincing but was more amusing. He did not think much of engineers and science workers. Among other things, he said, "We think the term 'professional' is an apt one to describe those who practise their theoretical training, but to describe them as professionals in the same sense as doctors and lawyers is fictitious and misleading," and "their position is analogous to other groups performing specialized services such as toolmaking." As an argument against separate legislation he said, "Any proposal to elevate individual technicians within a group to a snobbish and priestly caste, and to alienate them from their colleagues, is detrimental to morale and should be frowned upon."

The representative of the Canadian and Catholic Confederation of Labour stated:

> "We are not prepared to deal with the federal code as far as it concerns professional employees. If they wish to be covered by the federal code, we have no objection. If they do not insist on that, we are not asking for it. We believe that the interested parties should deal with their own problems and if they offer a solution which they think is a good one, we are ready to support it."

Again it can be said that the day's experience was a bit of an education. If eventually engineers have to bargain collectively through, or in opposition to, trade unions, this day's exhibition should be very helpful, but as far as progress is concerned, "there is nothing to report".

***Seated** (**left to right**)*—**J. A. Lalonde, councillor E.I.C.; L. Austin Wright, general secretary E.I.C.; de Gaspé Beaubien, president E.I.C.; C. C. Lindsay, president C.P.E.Q. and chairman of Montreal Branch E.I.C.; A. D. Ross, secretary-treasurer C.P.E.Q.; P. E. Poitras, councillor C.P.E.Q. and councillor E.I.C.** ***Standing** (**left to right**)*—**Louis Trudel, assistant general secretary E.I.C.; J. E. Armstrong, councillor E.I.C.; R. E. Heartz, councillor E.I.C.; E. V. Gage, councillor E.I.C.; G. A. Gaherty, member E.I.C. Committee on Professional Interests; J. B. Stirling, chairman E.I.C. Committee on Professional Interests; Marc Boyer, special representative C.P.E.Q.; E. A. Ryan, councillor C.P.E.Q.; J. A. McCrory, councillor C.P.E.Q.**

FIFTH MILESTONE

The fifth milestone on the journey from individual effort to complete cooperation between professional engineering organizations in Canada was passed on Saturday, January 20th, when the officers of the Corporation of Professional Engineers of Quebec and The Engineering Institute of Canada signed the recently approved agreement for cooperation. This brings the Institute into direct alignment with five out of the eight provincial organizations. In a sixth province, Manitoba, a ballot was submitted successfully to the membership of both organizations some time ago but certain amendments necessary to the by-laws of the Association are still pending.

The signing officers of the Corporation were C. C. Lindsay, president, A. D. Ross, secretary-treasurer, with Paul E. Poitras and E. A. Ryan as witnesses. For the Institute, deGaspé Beaubien signed as president and L. Austin Wright as general secretary. J. A. Lalonde and J. B. Stirling were the witnesses. The ceremony took place at the headquarters of the Institute before officers, councillors and members of both organizations.

A point of great importance is that the privilege provided by the agreement relative to remission of entrance fees is available only to those who take advantage of it within ninety days of the effective date of the agreement. Thus, the privilege expires on March 31st, 1945. In order to remind members of the Institute in Quebec who are not members of the Corporation, a letter has gone out from the president urging that immediate action be taken. A similar communication has been circulated to members of the Corporation by its president, C. C. Lindsay.

The agreement provides that persons who were members of either organization at the time of signing will not be required to pay the entrance fee of the other organization if they desire to become members of both, and others joining either body subsequent to the date of the agreement are given the same privilege.

The agreement is somewhat different from those entered into in Alberta, Saskatchewan, New Brunswick and Nova Scotia, due to conditions which apply only in the province of Quebec. For instance, the Quebec Corporation is the only provincial registration body that grants full membership to a person just graduated, regardless of his age or experience. This procedure is in line with that followed in medicine and law, but is quite different from that followed in engineering in the other seven provinces and also from the requirements for membership in the Institute. It has been made necessary by provincial conditions that do not exist in the other provinces.

A further feature is that a joint committee is to be established immediately to study the possibilities of developing an extensive cooperative programme beyond that already provided by the agreement. It is believed that Quebec presents unique opportunities for cooperation, and it will be the duty of the joint committee to develop and submit ideas on a continuing basis.

The completion of this fifth agreement will be a matter of gratification to engineers in Quebec as well as elsewhere, particularly to the groups in every province who have worked so long and arduously in the interests of cooperation within the profession. It remains for the engineers in Quebec to signify at the earliest date their desire to become joint members, thereby transmuting words into deeds.

AMERICANS HONOUR CANADIAN ENGINEERS

At the recent annual meeting of the American Society of Civil Engineers, an honorary membership in the society was conferred on Arthur Surveyer, a past-president of the Institute. Dr. Surveyer was presented for the honour by Institute Past-President J. B. Challies who made the following citation:

Mr. President and Members of the American Society of Civil Engineers:

"It is a great privilege for me to present Dr. Arthur Surveyer for that outstanding and well-guarded distinction in the engineering profession—honorary membership in the American Society of Civil Engineers. In so recognizing a distinguished Canadian engineer, your Board has also paid a gracious and much appreciated compliment to the national engineering society of the Dominion, since Dr. Surveyer was president of The Engineering Institute of Canada in 1924 and 1925.

"Ever since its inception in 1887, the Institute has enjoyed and profited by close relations with the American Society of Civil Engineers; indeed, our first and founder president, the late Thomas Coltrin Keefer, became your president in 1887. In the interval you have emphasized, with great discernment, the good relations which exist between our two organizations. Twice you have called leading members of the Institute to your Board of Direction; thrice you have awarded honorary membership to one of our past-presidents. It is an interesting fact that by your action to day our three senior living past-presidents have their names included in your Roll of Honour.

"Dr. Surveyer's academic standing is well attested. A Bachelor of Arts of Laval in 1898; a Bachelor of Applied Science in Civil Engineering of the Ecole Polytechnique in 1902; a post-graduate of the Ecole Spéciale d'Industrie et des Mines du Hainault, Mons, Belgium; an Honorary Doctorate of Engineering of Rensselaer Polytechnic Institute in 1925 and an Honorary Doctorate of Laws at Montreal University in 1942.

"His professional attainment is such that a leading financial paper of Canada recently said a list of his clients reads like a 'Who's Who' of Canadian corporations.

"His public service includes membership during both War I and War II in the National Research Council; an active member for 25 years of the Corporation of his own Alma Mater; a founder and for many years a director of the Canadian Institute of International Affairs; a member of the Federal Government Committee on Reconstruction and presently chairman of the Committee on Post-War Planning of the Canadian Chamber of Commerce.

"Mr. President, this brief recital of his attainments will explain why a past-president of The Engineering Institute of Canada can with pride now ask you to present Dr. Arthur Surveyer with the official evidence of the distinctive honour that your Board of Direction has so fittingly awarded him."

The president of American Society of Civil Engineers, in conferring the honour, said, in part:

"Upon completion of his studies in Belgium, Surveyer returned home for a position with the Department of Public Works of Canada. (Montreal was and is home to Arthur Surveyer, for he was born there in 1878 and has maintained an office there for many years.) After several years of experience on design and construction, he established the firm of Arthur

Dr. A. Surveyer

Surveyer and Company. For 33 years this firm has designed and supervised many important engineering works and has specialized in investigations for banking firms, public utilities and industrial corporations.

"Among these assignments were the preliminary design and estimate for a 240,000-hp. development on the Ottawa River at Caribou; preliminary design and estimate for a 70-ton Kraft paper mill; plans for a 1,500,000-gal. reservoir of reinforced concrete for the Canadian Pacific Railway; design and supervision of the construction of a six-storey department store in Montreal for Dupuis Frères.

"Dr. Surveyer's ability as an impressive, serious, and mildly witty after-dinner speaker is well known. It was demonstrated at the Special Meeting of the Society held in Buffalo a number of years ago, when he responded for Canada to a toast to the engineering profession. When he finished, the whole company stood up and gave him a hearty reception.

"On a famous occasion in Toronto when engineers from all over the Dominion were gathered for what was termed a 'tribal shout' to celebrate the selection of an engineer as Chairman of the Ontario Hydro-Electric Power Commission, Dr. Surveyer stole the show, notwithstanding the fact that well-known speakers from other professions were present. Like all good speakers, he thinks his own efforts are terrible and he does his best to avoid special assignments, but once he takes one on he can be depended upon for an original, apt, timely, and appealing speech.

"One of Dr. Surveyer's principal interests in recents years has been the Canadian Institute of International Affairs, of which he was one of the founders and is to-day one of the directors. Perhaps there are few Canadians, outside of those who are giving full time in the diplomatic service and other fields of international affairs, who are better posted on international questions than he. At nearly every round-table discussion on these matters on either side of the boundary among semi-official and unofficial groups during the last ten years he has been one of the principal speakers.

"Dr. Surveyer has taken a very deep and continuous interest in the Ecole Polytechnique, the French-Canadian Engineering Faculty connected with Montreal University. The fact that graduates from this faculty are sought after, and are to-day occupying important positions, throughout industrial Quebec is due to a large extent to his leadership. In the Great War, Dr. Surveyer was asked by the Government of Canada to help organize the National Research Council—a body of leading Canadian scientists from the principal universities, with two consulting engineers, one the late Dr. R. A. Ross, Past-President of The Engineering Institute of Canada, and the other Dr. Surveyer, also a Past-President of the Institute. Dr. Surveyer is still a member of the Research Council, which has been responsible for inspiring the solution to technical problems of tremendous import to Canada's war effort.

"Perhaps the best example of the difficulty of applying theory to practice is that to be found in Dr. Surveyer's outstanding ability to explain the theory of hooks and slices in golf, accompanied by his great difficulty in keeping his score below 100. Dr. Surveyer can expound learnedly upon the reasons for each of the six different kinds of slices, but he cannot explain why on the fairway in the course of a game he cannot keep from demonstrating each of these different kinds at least once. Notwithstanding his learned expertness on the theory of golf and his ability to expound his theory, he is a popular member of the Royal Montreal Golf Club, the oldest and the original golf organization on this continent, founded in 1872. All his English friends envy him his outstanding ability to use the King's English, both in speech and in writing, although at all times he is most retiring and unassertive.

"In addition to his engineering practice, Dr. Surveyer has served as director of the Shawinigan Water and Power Company, the Chromium Mining and Smelting Corporation Ltd., and the Holland-Canada Mortgage Bank. He also has been a Commissioner-Censor of Credit Foncier Franco-Canadien. He was a member of the Canadian Council for Industrial and Scientific Research from 1917 to 1924, of the Canadian Research Council from 1942 to date, and of the Canadian Advisory Committee on Reconstruction in 1943.

"Dr. Surveyer became a Member of the Society in 1924. He is also a member of The Engineering Institute of Canada, of which he was president in 1924 and 1925, being one of four men to hold this position for more than one year since the founding of the Institute in 1880. He is also a member of the Corporation of the Ecole Polytechnique de Montreal, the Corporation of Professional Engineers of Quebec, the American Economic Association, and the American Management Association. He is the representative of The Engineering Institute of Canada on the Council of the Engineers' Council for Professional Development, and is chairman of the Committee on Postwar Policies of the Canadian Chamber of Commerce.

"Thus it is an outstanding French-Canadian member of the profession who becomes an Honorary Member of the Society in the person of Dr. Surveyer.

CHEMICAL INSTITUTE OF CANADA

The following progress report from the new Chemical Institute of Canada has been prepared for *The Engineering Journal* by the Interim Director of Information of the C.I.C. The *Journal* is pleased to bring these developments to the attention of its readers.—Ed.

The Chemical Institute of Canada has now successfully completed the first half-year of its existence. The Institute was founded in Toronto in June 1944, in answer to an overwhelming mandate on the part of Canadian chemists and those associated with Canadian chemical industry. It is an amalgamation of the Canadian Chemical Association, the Canadian Institute of Chemistry, and the local sections of the Society of Chemical Industry. It will serve as a truly unified and national organization.

The past six months have been devoted chiefly to necessary work of organization on the part of the Interim Board of Directors. Much work remains to be done, but sufficient has been accomplished so that the Institute can offer a full complement of services to its members as of 1st January 1945. Accordingly it is now actively soliciting members.

A few highlights of the Directors' Report to Council follow. The appointment of Mr. H. W. Lea, Director of the Wartime Bureau of Technical Personnel, Ottawa, as General Manager and Secretary, with effect as of 1st October 1944, was confirmed. Mr. Lea has already busied himself with the affairs of the Institute, and has paid one official visit to the Maritime Provinces. Other visits to Local Sections across Canada will follow. The national headquarters of the Institute has been established temporarily in Toronto, but when circumstances permit, will be moved to Ottawa.

Mr. W. E. Pomeroy, Toronto, Director of Conferences, reported that the Directors had accepted on behalf of the Institute an invitation to hold the first Annual Conference at Quebec City in June. Mr. Pomeroy was chairman of a sub-committee, composed of Mr. D. C. Lloyd of Montreal and Dr. J. J. Rae of Toronto, which has drafted a Charter and By-laws. It is proposed to amend the Federal Charter of the Canadian Institute of Chemistry, granted in 1921. The By-laws, however, are entirely new. They are intended to perpetuate all the good features of the amalgamating organizations, and to add many new services. In particular the By-laws provide for two classes of members, professional and non-professional, both of equal status. Professional interests will be cared for by a standing Professional Affairs Committee of the Council. The Institute will function locally through Local Sections, Subject Divisions, and Student Chapters. Action in legislative matters is provided for by Provincial Branches. Elections will be held nationally and also through Electoral Districts. The first elections will be held this spring.

Plans are well advanced with a view to the establishment of a national Speakers Bureau and a number of Subject Divisions.

Dr. H. R. L. Streight, Montreal, Director of Business, has been organizing a membership campaign on a national scale. During the month of January ten thousand chemists or persons interested in chemistry across Canada will receive a brochure, outlining the history, objects and services of the Chemical Institute of Canada, and an application form. Fees have been set as low as possible, commensurate with rendering the many worthwhile services which have been planned. Interested persons are asked to write to Mr. H. W. Lea, General Manager and Secretary, Chemical Institute of Canada, Room 605, 137 Wellington St. West, Toronto, Ont.

Other members of the Board of Directors, without portfolio, all of whom have made invaluable contributions, are: Mr. A. F. G. Cadenhead, Shawinigan Falls, Chairman of the Interim Council; Dr. Paul E. Gagnon, Quebec, Treasurer; Dr. R. H. Clark, Vancouver, Dr. T. Thorvaldson, Saskatoon; Dr. R. K. Stratford, Sarnia; Dr. R. R. McLaughlin, Toronto; and Dr. C. C. Coffin, Halifax, Directors.

After the acceptance of the Directors' Report on the 16th, the Council of the Canadian Chemical Association, the Council of the Canadian Institute of Chemistry, and the Canadian Council of the Society of Chemical Industry, met separately on the 17th. The Canadian Chemical Association will be disbanded as soon as its financial affairs are put in order. The Canadian Institute of Chemistry will continue in being only so long as may be necessary to secure an amendment to its charter. The S.C.I. has formed a single Canadian Section and will cease all local activities.

NEW PRIZES

Although authorized by Council in 1942 the Keefer and Ross Medals are awarded this year for the first time. With their inauguration, the Institute now has an award for the best paper in each branch of engineering.

The Keefer Medal is established in honour of T. C. Keefer, the first president of the Institute who, incidentally, had the unique experience of being president of the American Society of Civil Engineers in 1888, the year after he presided over the affairs of the Canadian society. It is awarded for the best paper on a civil engineering subject.

The Ross Medal commemorates the name of R. A. Ross, president of the Institute in 1920, who devoted a large portion of his time and energy in advancing the affairs of the Institute and the profession. He was an electrical engineer of great repute. The medal is awarded for the best paper on an electrical engineering subject.

The first winner of the Keefer Medal is Max V. Sauer, M.E.I.C., for his paper, "St. Lawrence River Control and Remedial Dams—Soulanges Section", and of the Ross Medal, R. A. H. Hayes, M.E.I.C., for his paper "Electrical Equipment at Shipshaw".

Canadian Lumbermens' Association Prize—Another prize awarded this year for the first time has been made possible by a contribution of $100.00 each year from the Canadian Lumbermen's Association. The first winner is Carson F. Morrison, M.E.I.C., for his paper, "Modern Timber Engineering".

For the information of members, the balance of the list of prizes is given herewith:

The Sir John Kennedy Medal—To commemorate the great services rendered to the development of Canada, to engineering science and to the profession by the late Sir John Kennedy, past-president of the Institute. "Awarded as a recognition of outstanding merit in the profession, or of noteworthy contribution to the science of engineering, or to the benefit of the Institute".

The Julian C. Smith Medal—Founded to perpetuate the name of the late past-president of the Institute —Awarded for "achievement in the development of Canada".

The Gzowski Medal—Founded by Sir Casimir Gzowski, president in 1889-90-91. Awarded for the best paper of the year on any subject.

The Duggan Medal and Prize of $100.00—Founded by G. H. Duggan, president in 1916, for papers dealing with the use of metals in moulded or fabricated shape for structural or mechanical purposes.

The Leonard Medal—Founded by Lieut.-Col. R. W. Leonard, president in 1919, for the best paper on a mining subject presented either to the Canadian Institute of Mining and Metallurgy or to The Engineering Institute of Canada.

The Plummer Medal—Founded by J. H. Plummer, D.C.L., for the best paper on chemical and metallurgical subjects. Open to members of the Institute, or non-members if the paper has been presented to an Institute or a Branch meeting.

Prizes to Students and Juniors—Five prizes of books or instruments to the value of $25.00 for the best papers presented by Students or Juniors in the vice-presidential zones of the Institute.

The H. N. Ruttan Prize (Western provinces)
The John Galbraith Prize (The province of Ontario).
The Phelps Johnson Prize (English) (The province of Quebec).
The Ernest Marceau Prize (French) (The province of Quebec).
The Martin Murphy Prize (The Maritime provinces).

Prizes to University Students—Twelve cash prizes of $25.00 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.

UNRRA

So that members may be informed of the most recent situation with regard to personnel for the United Nations Rehabilitation Administration, the latest letter from the Director of Personnel is presented herewith.—(*Ed.*)

6 January, 1945.

"Mr. Louis Trudel,
Assistant General Secretary,
The Engineering Institute of Canada,
Montreal, P.Q., Canada.

"Dear Mr. Trudel:

"We have recently prepared a list of Canadians now serving on the staff of UNRRA which I am forwarding to you for your information. You will note that we have approximately one hundred persons now on the staff, and I am happy to say that they are very high-grade people. I want to express our thanks to you for your assistance in helping us to find suitable persons.

"At the present time there is a lull in our recruitment because of the delay in European operations of UNRRA, but presently we shall be looking for persons for the displaced persons programme in Germany for such positions as assembly center director and deputy director, welfare workers, and administrative officers. I shall advise you more specifically when we have more information, and I bespeak your continued cooperation. May I extend to you the best wishes of the season.

"Yours sincerely,
(*Signed*) Joseph P. Harris,
Director of Personnel.

DRAFT ORDER IN COUNCIL FOR REGULATION OF LABOUR RELATIONS OF PROFESSIONAL AND SCIENTIFIC WORKERS AND THEIR EMPLOYERS

At the request of the Committee on Employment Conditions, the Journal prints herewith the draft of legislation that has been proposed by the "Committee of Fourteen" and presented to the Minister of Labour. It was this draft that provided the basis for the recent appearance of the representatives of the "Committee of Fourteen" before the Wartime Labour Relations Board (National) in Ottawa. The brief presented to the Board on that occasion appeared in the January Journal.

There is still no indication of what will happen but with this draft and the brief before them, members will be in possession of the entire evidence as prepared by the committee, and will therefore be in a position to appraise the decision when it is made.—ED.

NOTE:—This Draft Order-in-Council is an adaptation of P.C. 1003. It incorporates new provisions or amends Provisions in P.C. 1003 only so far as is necessary to make the principles, machinery, and language of latter applicable to professional and scientific workers as distinct from employees generally.

In order to make clear what is new or altered in this draft, the numbering of the provisions in P.C. 1003 has been retained and specific reference is made as to each provision which is to be altered or retained and to new provisions to be inserted.

The Minister of Labour has the honour to report:

THAT the Wartime Labour Relations Regulations were passed to facilitate the negotiation of collective agreements, and the adjustment of differences between employers and employees, particularly in industries essential to the prosecution of the war;

THAT many employees are members of professional associations incorporated under the laws of Canada or of the provinces, or hold degrees in various branches of science from recognized Universities, and are employed in work of a professional or scientific nature;

THAT by reason of their professional or scientific training or of their membership in such professional associations such employees share common interests affecting their professional or scientific capacities rendering it desirable that they should be able to deal with an employer or group of employers as a unit distinct from other employees in the conduct of negotiations and the adjustment of differences in respect of the terms and conditions of their employment;

AND THAT it is advisable and conducive to the war-effort to make provision for the regulation of the labour relations of such professional and scientific workers and their employers on the same principles as, but separately from, those contained in the Wartime Labour Relations and to set up a separate Board to administer the same.

N.B.—Above recitals are new.

Accordingly the undersigned has the honour to recommend that His Excellency the Governor-General in Council may be pleased, under the authority of the War Measures Act, Chapter 206 of the Revised Statutes of Canada, 1927, to make the following Order:

Short Title

SECTIONS

1. These Regulations may be cited as the Wartime Labour Relations (*Professional Workers*) Regulations (*Change*).

Interpretation

2. (1) (a) *No change.*

(b) "Board" means the Wartime Labour Relations (*Professional Workers*) Board; (*change*).

(c) *No change.* (d) *No change.* (e) *No change.*

(f) "Employee" means the employee of an employer who is employed in his capacity as a professional worker as herein defined; but does not include a person who though a professional worker within the meaning of this Order is employed in an executive or other capacity distinct from his professional or scientific training. (*amended*).

(g) "Employer" means any person, firm or corporation employing three or more employees and includes His Majesty in right of Canada and any board, commission or other body incorporated to act as agent of His Majesty in right of Canada; it does not include His Majesty in right of any Province, or any department, branch or agency of any provincial government or any municipal corporation, unless and to the extent that the Lieutenant-Governor in Council of the Province concerned by Order consents to the application thereto of this order. (*Amended*).

(h) *No change.*

(i) "Employees' organization" means an organization of employees *in whole or in part* formed to regulate relations between employers and employees, *and includes a "professional association" as herein defined.* (*Change*).

(j) *No change.* (k) *No change.* (l) *No change.*

(ll) "Professional association" means an association of a kind specified in clause (lll) of this sub-section. (*New*).

(lll) "Professional worker" means an employee who

(i) is a member of an association incorporated by provincial law for the purpose of controlling the admission to, and regulating the practice of the professions of engineering, land surveying, architecture, of chemical, metallurgical, physical, geological, or biological science, or who is registered by such association as a candidate in training for admission thereto;

(ii) is a member of an association incorporated by Dominion law for the promotion and advancement of knowledge and standards of any of the professions aforesaid; or

(iii) holds a degree in engineering, chemistry, metallurgy, physics, geology, biology, architecture or other branch of science from an university or college recognized by the Board for the purpose of these Regulations, or who is taking a course leading to such a degree from an university or college so recognized. (*New*).

(m) *No change.* (n) *Delete.* (o) *No change.* (p) *No change.*

(2) *No change.*

APPLICATION

3. *No change.*

RIGHTS OF EMPLOYEES AND EMPLOYERS

4. *No change.*

CERTIFICATION OF BARGAINING REPRESENTATIVES

5. (1) *No change.*

(2) If the majority of the employees affected are members of one *employees' organization,* that organization, *if so requested by the majority of employees aforesaid,* may elect or appoint its officers or other persons as bargaining representatives on behalf of all the employees affected; for the purpose of this section an employee shall be deemed to be a member of the employees' organization if he has in writing requested that organization to elect or appoint bargaining representatives on his behalf. (*Amended*).

(3) Where more than one employer and their employees desire to negotiate a collective agreement, the employees of such employers may elect bargaining representatives by a majority vote of the employees affected of each employer, or, if the majority of the employees affected of each employer are members of one *employees organization, that organization, if so requested by the majority of employees as aforesaid,* may elect or appoint its officers or other persons as bargaining representatives on behalf of all the employees affected. (*Amended as shown in it lics*).

(4) Where the employees' organization referred to in sub-sections (2) and (3) hereof is a professional association of which the employer concerned is a member that employer shall not participate in any way in any proceedings of the association relating to the request of the employees affected that the association elect or appoint bargaining representatives on their behalf nor shall he act as such a bargaining representative. (*Substitute for present sub-section (4)*).

(5) *Delete.* 6. *No change.*

7. Upon such application the Board shall, by an examination of records, by a vote or otherwise, satisfy itself that an election or appointment of bargaining representatives was regularly and properly made, and in the case of *an employees' organization, that the organization* acted with the authority of the majority of the employees affected as prescribed by sub-section two of section five, and that the unit of employees concerned is one which is appropriate for collective bargaining; and if the Board is not so satisfied, it shall reject the application. (*Change in italics*).

8. *No change.* 9. *No change.*

NEGOTIATION OF COLLECTIVE AGREEMENT

10-14. *No change except deletion of words "trade union or" in Section 10 (3).*

DURATION AND RENEWAL OF AGREEMENTS

15-16. *No change in these sections as amended by P.C. 6893, Sept. 1, 1944.*

GRIEVANCE PROCEDURE

17-18. *No change.*

UNFAIR PRACTICES

19. (1) No employer shall dominate or interfere with the formation or administration of an employees' organization or contribute financial or other support to it; *provided that where the employees' organization concerned is a professional association to which the employer and some of his employees belong it shall be lawful for the employer to pay his membership fees to that association*; and also provided that an employer may permit an employee or representative of an employees' organization to confer with him during working hours or to attend to the business of the organization during working hours without deduction of time so occupied in the computation of the time worked for the employer and without deduction of wages in respect thereof. (*Amended as italicised and with deletion of reference to trade unions*).

(2) *No change.*

20. (1) and (2) *Delete reference to trade union.* (3) *Omit.* (4) *Delete "trade union".*

STRIKES AND LOCK-OUTS

21. *No change.*

INFORMATION

22. *Delete references to trade union.*

ADMINISTRATION

WARTIME LABOUR RELATIONS (PROFESSIONAL WORKERS) BOARD

23. There shall be a Board which shall be known as the Wartime Labour Relations (Professional Workers) Board and shall consist of a chairman, and of four other members, two of whom shall be appointed as representative of professional workers and two as representative of employers of professional workers. (*Changed*).

24. *No change.*

25. (1) *The Board shall decide all questions necessary to the effective operation of this Order, whether the same have been raised by parties or otherwise* and its decision thereon shall be final and conclusive for all purposes of this Order. In particular the Board shall decide the following questions:

(a) Whether a person is an employer or employee or *a professional worker* or whether an organization or association is an employees' organization or employers' organization or *professional association;*

(b) The unit of employees appropriate for collective bargaining in a particular case;

(c) Whether an agreement is a collective agreement; and

(d) Whether an employer is, or certified bargaining representatives are, negotiating in good faith.

(*Revised as italicised and substituted for original section.*)

26. (1) The Board may, by order delegate to any person, board or association all or any part of its jurisdiction relating to any particular

matter *or class of matters.* (*Revised as italicised.*)

(2) *No change.*

27. *No change.* 28. *No change.*

CONCILIATION OFFICERS AND BOARDS

29-35. *No change except deletion words "trade union or" in Section 31* (*1*).

GENERAL

36-37. *No change.*

ENFORCEMENT

38-46. *Delete references to "trade union" in Sections 41* (*2*), *42 and 44* (*2*).

MISCELLANEOUS

47. *No change.*

48. (1) The Industrial Disputes Investigation Act, *and the Order in Council made on the sixth day of June, nineteen hundred and forty-one* (*P.C. 4020*) *as amended,* shall except as to matters pending when this Order comes into force, be of no effect while this Order is in force. (*Revised*). (*Changed as italicised*).

(2) *Omit.* (3) The Wartime Labour Relations Regulations, P.C. 1003, February 17, 1944, shall not apply to employers and employees covered by these Regulations. (*Substituted for present sub-section*).

49. *No change.*

SCHEDULE A

No change.

HUMPHREY MITCHELL,
Minister of Labour.

WASHINGTON LETTER

Too Much Too Soon

The last month has seen much recasting of plans. On the supply and production side, the position has changed greatly. In some respects it looks as though the coming year may be as difficult from a supply point of view as any year so far. This is due to a number of factors. It is now necessary to plan for the continuance of a two-front war throughout 1945. Krug has announced the recasting of all War Production Board plans on the basis of the assumption that the war in Europe "will continue indefinitely". All Stage II talks are being filed away for the time being. The tempo of the war in both Europe and the Pacific is being stepped up and battle experience has shown that the consumption of material on both fronts has been higher than was anticipated. This has been particularly true with respect to ammunition, rockets and mortars. Several large new projects have been authorized. As an example, a two hundred million dollar plant for the production of mortars is being rushed to come into operation in August of this year. The Army expects to need an additional million men by the middle of the year. The main difficulties will be with manpower shortages although there will be instances where shortages of basic raw materials will also cause difficulties. The May-Bailey bill proposing a limited National Service Act is being debated in the House as this is written and strong letters have been written by the President, General Marshall, Admiral King and by the Undersecretaries of War and Navy. Another difficulty in the supply position arises from the fact that the civilian economy in this country has been relying on accumulated stocks which it was hoped would last until some reconversion to civilian production could be effected. However, all thought of reconversion has now been shelved and Krug has warned that civilian industry is facing tighter restrictions. Rationing controls have been strengthened and their scope may have to be extended.

Another factor in the supply position is the necessity for maintaining the economies of occupied countries. This task also is proving by experience to be even more difficult than was anticipated. Mr. Richard K. Law, British Minister of State, left Washington within the last couple of days after having taken part in a series of confidential discussions on the economic problems arising out of the liberation of large parts of Europe. The problem is a particularly difficult one. It is sufficiently complicated by the necessary disruption of European economies set up during the German occupation and the unavoidable destruction of transportation and port facilities. One of the main problems, however, is a critical shortage in shipping.

A world-wide shortage in coal has also been the subject of a number of studies and War Mobilization Director Byrnes has recently called for a "brownout" and issued instructions for the curtailment of the use of power, light and heat. Heavy trucks and tires are also subjects of special study and concern, and upward revisions in production targets. In general, every attempt is being made to undo the damage and prevent the recurrence of the stampede of optimism of three months ago. No doubt there will be some leaning over backward, and the new Russian drive may drastically alter the picture, but the new watchword seems to be "too much too soon".

Diplomatic Developments

On the diplomatic front, developments have also moved forward rapidly. Mr. Stettinius' much discussed reorganization of the State Department is settling down to work. Within the last week, Secretary Stettinius has suggested periodic meetings of Foreign Secretaries of the principal United Nations. He has urged that the three big powers should band together to guarantee the peace and in this connection has come out in commendation of Republican Vandenberg's recent important speech. Vandenberg's speech has been widely acclaimed as an important step forward in American foreign policy. The speech moves out of the realm of theory and takes a stand against any principle of postponing important political decisions until the war's end. The speech aims at clearing up a lot of the present difficulties in respect to the so-called unilateral European arrangements at present made necessary by the lack of any settled policy respecting the guaranteeing of peace. It is felt in many quarters that Vandenberg's suggestion that the United States, the United Kingdom and Russia should move now to guarantee the demilitarization of Germany and Japan would go a long way torward clearing the general atmosphere, and a long way toward implementing Article XII which is one of the keystones of the Dumbarton Oaks proposal. Recent press reports predict that Stettinius will attend the forthcoming Three Power parley. As this is written Senator Connally, chairman of the Senate Foreign Relations Committee, is entering a proposal for an Interim United Nations Council and Democratic Senator Wheeler has entered the international lists with a number of suggestions of his own. The President has just announced, on the day after his inauguration, that ex-Vice President Wallace will take over from Jesse Jones as Secretary of Commerce. Meanwhile the furore caused by the London *Economist's* article has died down and Mr. Churchill's latest speech has been well received.

Scientific Wonders

On the engineering and scientific front it is becoming increasingly possible to release information which has previously been restricted. The superb work which is being done by Army engineers in temporary bridge work, both with bridges of the Bailey type and with new and highly developed pontoon-type bridges is beginning to appear in print and will constitute an interesting chapter in the art of bridge building. A recent article describes the fire resistant timber construction for the large U.S. Navy hangars with their 258-ft. span arches. The switching of equipment and material from the European theatre to the Pacific theatre has introduced a number of complicated problems of packaging, preservation and tropic proofing. These problems have called for ingenious solutions, sometimes even calling for the redesign of the equipment itself. Rockets and rocket ammunition is daily coming into greater prominence. Many manufacturing techniques such as the use of the rubber die, continuous injection moulding, the use of plastics, sub-zero treatment of steel, and many other techniques have been advanced by war-time necessities. Particularly marked have been the advances in rubber and synthetic rubber. The new Koroseal lends itself to many purposes. New smooth rubber for bearings has been developed. Oil resistant rubbers, rubber that will stand up to sub-zero temperatures, and a rubber which will carry electricity and eliminate the static hazard have been amongst the many problems solved by the industry.

Interesting also have been recent articles on the scientific choice of bombing objectives. The extremely thorough and painstaking air campaign against the German ball-bearing industry, calculated to affect the whole range of German war-time production, is a case in point. The concentration on the destruction of locomotives and the concentration on oil and gasoline refineries are also good examples.

Washington, D.C., E. R. Jacobsen, M.E.I.C.
January 21st, 1945.

CORRESPONDENCE

Method for Drawing Approximate Ellipses

457 Elm Ave., Westmount, Que.
January 8th, 1945.

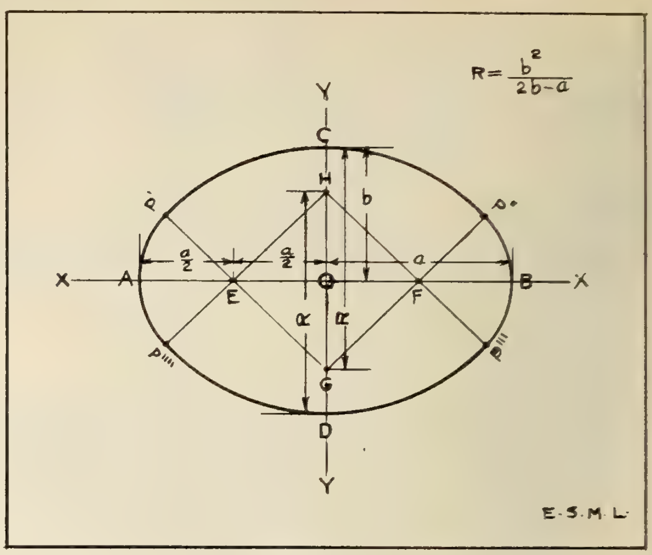
The Editor,
The Engineering Journal
Dear Sir:

During the past year, while engaged as a draughtsman on plans, tracings, etc., in connection with minesweeper vessels, the writer had occasion to draw a great number of small ellipses (manhole covers to fuel tanks, side and deck openings for anchor chains, etc.) and at first experienced some difficulty in doing this.

Text books, it is true, give graphical methods (using circular arcs) for drawing approximate ellipses and, while these do well enough when the drawing is of an appreciable size, they were found to be useless for small ovals (too much construction work on too small a space).

It was easier in fact to find by trial, arcs that would approach the required dimensions of the oval. This method, too, was not very satisfactory as it was hard to keep the junction points of the arcs from overlapping, and besides the many perforations made in the paper by the compass points were not desirable.

Under these circumstances, the writer worked out a method (indicated below) which gave excellent results and which may or may not be known to others.



Letting a equal half the long diameter
and b equal half the short diameter,

then the radius for the small arcs is always $\frac{a}{2}$.

The radius R for the large arcs is given by

$$R=\frac{b^2}{2b-a}$$

As the dimensions b and a are usually in even feet or inches, the value for R can, in most cases, be found mentally in a few seconds. The rest is easy.

Fine pencil lines joining the centres as indicated are produced until they cut the small arcs at the points P′, P″, P‴, P⁗, and these points become the junctions of the small and large arcs.

It might be noted that the arcs have common tangents at these junction points, for the derivation of the formula giving R was based on this assumption.

Also to be noted, is that the formula is applicable in every instance. For example:

If $a=b$, then $R=b$, and the figure becomes a circle.

If $b=\frac{3a}{4}$ or $a=\frac{4b}{3}$, then $R=\frac{3b}{2}$, and the centres for the large arcs lie midway between the points O and C, and O and D.

If $b=\frac{2a}{3}$ or $a=\frac{3b}{2}$, then $R=2b$, and the centres for the large arcs lie at the extremities of the short diameter.

If $b=\frac{3a}{5}$ or $a=\frac{5b}{3}$, then $R=3b$, and the centres fall outside the figure.

Finally, if $b=\frac{a}{2}$ or $a=2b$, then R becomes infinite and the oval has flattened out until the figure becomes two semi-circles of radius $\frac{a}{2}$ joined by straight lines.

In the example shown, drawn to a scale of one inch to the foot, a was taken as 21 inches, $b=15$ inches, therefore, $R=\frac{15\times15}{(2\times15)-21}=\frac{225}{9}=25$ inches, and E, F, G, and H become the centres from which the arcs are struck.

When b is made $\frac{2a}{3}$, that is, when the centres for the large arcs lie at the extremities of the short diameter, it will be found that the resulting figure approaches so closely to an ellipse of similar dimensions that it could, virtually, be almost superimposed upon it.

It would seem therefore that, in designing and building concrete arches, so far as symmetry and utility are concerned, such an oval might well be used in place of the true ellipse.

It is chiefly, however, in the hope that it might be of use to other draughtsmen that the method outlined above is now submitted.

Yours very truly,

Signed E. S. M. Lovelace, M.E.I.C.

MEETINGS OF COUNCIL

A meeting of the Council of the Institute was held at Headquarters on Saturday, December 16th, 1944, at nine thirty a.m.

Present: President deGaspé Beaubien (Montreal), in the chair; Vice-Presidents L. F. Grant (Kingston) and C. K. McLeod (Montreal); Councillors J. E. Armstrong, R. S. Eadie, E. V. Gage, R. E. Heartz, J. A. Lalonde and P. E. Poitras of Montreal, H. R. Sills (Peterborough), J. A. Vance (Woodstock), and W. S. Wilson (Toronto); Secretary Emeritus R. J. Durley, General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

There were also present by invitation—President-Designate, Dean E. P. Fetherstonhaugh, of Winnipeg; J. B. Stirling, chairman of the Institute's Committee on Professional Interests; S. R. Frost, chairman of the Toronto Branch, and G. J. Currie, immediate past-chairman of the Halifax Branch.

Post-War Policy of the Institute (Rehabilitation of members in the Active Services)—The general secretary requested, in view of certain communications from officers of some of the Ontario branches, that Council give further consideration to the previously determined proposal to place in Toronto a new member of the staff whose duty it would be to assist in the rehabilitation of the members in the active services. The letters were from councillors in the Toronto and Hamilton branches and in each instance suggested that it might not be the best policy to place such a man in Toronto.

The president called on Mr. Frost, as chairman of the Toronto Branch, for an expression of opinion. Mr. Frost explained that the Toronto executive realized that a member of the staff placed in Toronto could give considerable help to the Toronto Branch, all of which was badly needed, but they didn't want other branches of the Institute to think that this man was placed there at their instigation as under such circumstances the branch would be adversely criticized. He referred to the work that such a man might do in relationship to other placement agencies in the province. He thought care should be taken that there would be no duplication of effort.

Mr. Frost went on to say that it had been suggested that the man might be located at Headquarters but that he might spend considerable time in the Toronto area. Under these circumstances he thought Toronto would have no complaint to make and would be glad to support the Institute in such a policy.

Mr. Wilson said that at the executive meeting of the branch a suggestion had been made that the money might be spent to better advantage in other things, such as an increased rebate to the branches and further assistance to the junior sections. He also announced that the Toronto executive had contemplated collecting an additional $2.00 per member in order to augment the branch finances but that no decision had been made which could be reported to Council.

The president explained that he understood that in most instances the branches had accumulated reserves of funds under the present rebate system. He thought that any general increase in rebates would only increase these surpluses and might not actually increase the activities. He pointed out the increase in Institute activities that could be realized if there were a greater income for Headquarters.

Colonel Grant was of the opinion that the discussion involved two separate items (a) an employment agent for getting men out of the forces and out of wartime industry into peace time occupation. He thought that if such a man were employed exclusively on this work the membership would respond generously to the request for a voluntary assessment to assist in financing the additional expense, and (b) rebates to branches, which he thought should not be introduced at the present time, although as a member of the Kingston Branch he appreciated the limitation under which at least some of the branches were working. He thought that a man to handle rehabilitation work should be placed at Headquarters but that ample provision should be made for him to visit all parts of Canada where his services were required.

The president reviewed the subject and the discussion and summarized it by stating that the question before the meeting was whether or not it was still the wish of Council that such a man should be employed and that he should be placed at Headquarters, and that as a means of meeting at least part of such costs the corporate membership be assessed on a voluntary basis a minimum amount of $2.00.

Mr. Vance stated that he was strongly in favour of employing such a man and that the membership at large should be given an opportunity to contribute.

Mr. McLeod moved that Council confirm its previous decision that a man be engaged for rehabilitation and that a voluntary assessment of $2.00 be made on all corporate members. This was seconded by Mr. Poitras.

In the discussion which followed Mr. Gage suggested that it might be desirable to appoint two such representatives, one with headquarters in Toronto and one with headquarters in Montreal. Mr. Lalonde inquired as to the proportion of the total cost that would be obtained by the voluntary assessment, to which the president replied that there was no means of finding out except by trying, but that many individuals had indicated a desire to contribute to such a work even well beyond the minimum amount which had been agreed upon. Dean Fetherstonhaugh agreed that a request to the membership at large would meet with a good response and he thought that Council should proceed on that basis. The motion was put to the meeting and carried unanimously.

Employment Conditions (Collective Bargaining)—Mr. Heartz, chairman of the Committee on Employment Conditions, gave a complete statement of conditions as they exist at the present time, including a review, clause by clause, of the proposed new order in council. He explained in many cases the reasons for the inclusion of certain clauses in the order in relationship to the existing order 1003.

He brought Council up to date on all the recent developments, announcing that an invitation had been sent out by the National War Labour Board to a great many organizations, including technical societies and labour groups to appear before it on January 9th to discuss the professional worker in relation to the existing order.

He also announced that a meeting of the fourteen societies had been called for December 20th in Ottawa so that the situation could be resurveyed and the plans of the group revised if it were found desirable or necessary. The sub-committee of three, consisting of Messrs. MacRae, Dobson and himself would meet in Ottawa on December 19th in order to prepare the presentation of the case for the general meeting on the following day.

Mr. Heartz indicated that there would be opposition to the new order being issued and he wanted to draw the attention of Council to the fact that if the new order were refused eventually, his committee's only option was to ask for total exclusion from the present order 1003. He based this statement on the results of the Institute's questionnaire which showed that over eighty-five per cent wanted collective bargaining if it could be secured through a new order or a suitable amendment to the present order that would give the professions control of their own bargaining agencies. In the event of such order or amendment not being obtainable the Institute membership voted sixty-five per cent in favour of obtaining total exclusion from 1003.

He pointed out the possibility of confusion between policies of different organizations as indicated in the fact that at least one provincial association of professional engineers had already established a bargaining agency under the title of The Federation of Employee-Professional Engineers and Assistants, and apparently was prepared to bargain under the existing order. He pointed out also that three out of four provincial associations with which the Institute had agreements had used the Institute questionnaire in canvassing their members and had obtained the same results. Therefore it seemed that these three associations and the Institute had no alternative but to ask for total exclusion in the event of being unable to get the new order.

In view of this possible confusion he thought it was very important that all organizations should be represented in Ottawa on December 20th, particularly the provincial professional associations.

In conclusion, Mr. Heartz moved the adoption of his progress report, including in it the approval of the proposed new order. This was seconded by Mr. Vance and approved unanimously.

Mr. Heartz continued with a further report from his committee dealing with the request of Council that the committee consider the suggestion made at the last meeting that the Institute give financial support to the proposed new collective bargaining agency for the province of Quebec, and approval to the establishment and form of the organization. In reporting, Mr. Heartz divided his subject into two parts—(a) the constitution of the proposed federation, and (b) the question of financial assistance. He explained that consideration of the new developments in relationship to the proposed new federal order had given him and the committee so much work since the last meeting of Council that they had had insufficient time to deal properly with the reference from Council. Therefore, in relationship to item (b) he reported as follows:

"The Institute Committee on Employment Conditions recommends that Council offer encouragement and financial support in the establishment of a collective bargaining organization in each province if and when requested by appropriate groups, to administer the new proposed Order in Council as submitted by the fourteen societies to the Minister of Labour, it being understood—

"That the bargaining organization be made up of and directed by representatives of all qualified organizations that wish to be included, and would bargain for all professional workers without regard to membership or lack of membership in any organization. In other words, a co-operative effort in which all qualified organizations would be closely affiliated, and all in accordance with agreement reached at Ottawa on August 15th and October 3rd, and with the terms of the proposed Order in Council.

"The committee is studying the constitution of the proposed Quebec Federation of Employee-Professional Workers but is unable to recommend to Council any action with regard to it at this time."

Mr. Poitras pointed out that he thought that there was some need of getting the new federation into action quickly as he had been informed that already a labour union was endeavouring to organize one of the large public utilities in Montreal and to include the engineers. He went on to explain the steps taken by the Corporation to bring together representatives of the various societies to form a federation similar to that which had been inaugurated by the Ontario Association of Professional Engineers. He further explained that the architects had expressed themselves as not being greatly interested because they were mostly self-employed. On the other hand the chemists wanted to bargain and would be glad to co-operate with other organizations in doing so.

Mr. Eadie asked Mr. Poitras if the public utility to which he had referred was being organized under Order 1003 or under the Quebec law. In response Mr. Poitras replied that it was under 1003. Mr. Eadie stated that he did not see how the engineers could be included inasmuch as they were excluded now from that order by a ruling of the Board.

Mr. Poitras said that he had had a report to the contrary and that the engineers' exclusion expired on October 12th. Mr. Heartz stated, at this point, that the Board had not withdrawn the exclusion on October 12th and that therefore engineers working in a professional capacity were still deemed to be working in a confidential capacity and therefore were excluded from the order.

Mr. Poitras explained that the Corporation believed it had a special responsibility in this matter and that it felt it a duty to assist in doing the best job possible. There was further discussion participated in by many councillors and eventually Mr. Eadie presented the following motion which was seconded by Mr. Sills and approved unanimously:

"In view of the discussion at today's Council meeting and of the representations of Mr. Poitras as to the urgency of the matter, Council requests its Committee on Employment Conditions to consider the problem further at the earliest moment and report to the president and the Finance Committee, who are hereby authorized to take whatever action is deemed advisable."

Rehabilitation of Members in the Armed Services—The general secretary asked Council to consider the advisability of setting up a committee to settle matters of policy relative to the rehabilitation of members in the active services. He felt that this whole matter should not be left to Headquarters but that a committee representative of the three services and of industry should be established immediately.

Council agreed that such a committee should be established and authorized the president to select a chairman with power to name his own committee.

The general secretary announced that a letter, over the signature of the president, had been prepared and also a questionnaire which it was proposed to send to every member of the Institute in uniform. This letter stated that the members in Canada wished to render a service to the men in uniform upon their rehabilitation, and asked the overseas members for certain information, as indicated on the questionnaire, which would be helpful in carrying out this work. It was proposed that the replies to these letters should be turned over to the committee for study and for determination as to policy.

Community Planning—The general secretary reminded Council that at the September meeting authority had been given to the president to select a chairman of a committee which would recommend to Council action which would be taken by the Institute to assist in developing the subject of community planning and the engineers' participation in it. Mr. Arthur Bunnell, of Wilson and Bunnell, Toronto, had been selected as chairman. Mr. Bunnell was now engaged as consultant on community planning by the Province of Ontario in its newly created Department of Planning and Development.

In response to the president's request, Mr. Bunnell had submitted the following proposal:

"I have recently had several conversations with various of my Toronto friends, some of whom are members of the Engineering Institute, some of the Town Planning Institute, some of the Royal Architectural Institute, and some just plain John Citizens, but all interested in planning.

"On Thursday last by invitation, I attended a meeting of the Council of the Royal Architectural Institute of Canada and exchanged ideas with them as to the re-establishment of the Town Planning Institute. We reached the following conclusions:

"1. That there was a great need in Canada for an organization to foster community, regional, provincial and national planning.

"2. That this could best be accomplished through an organization that admitted to membership, on an equal basis, all persons interested enough in the matter to join and that the members of the Engineering Institute of Canada and the Royal Architectural Institute of Canada, recognizing the need, should foster such an organization to the end that branches be established in all the larger centres across Canada.

"3. That both our organizations at the appropriate time, should convey to Mr. J. M. Kitchen, the Secretary of the Town Planning Institute, our deep appreciation for his having kept the charter alive through all its years of inactivity.

"That I should write to Mr. Kitchen, advise him of this meeting, the conclusions reached, and ask him if he would come with me and Mr. A. J. Hazelgrove, a member of the Council of the Royal Architectural Institute of Canada resident in Ottawa, and interview the appropriate officer in the Department of State with a view to ascertaining exactly what steps would have to be taken to revive the Institute and to amend its charter so as to provide for one class of membership only. As it stands, the Institute consists of honorary members, associate members, legal associate members, students and honorary associates.

"4. That contributions be sought from the Provincial and Federal Governments, all of whom at long last are displaying a tangible interest in planning, sufficient to enable the re-constituted institute to engage the services of an organizer with editorial ability to promote the formation of branches and to ensure the publication of a journal which would keep members informed not only of progress being made across Canada and in other countries, but would in addition serve as a medium of exchange of members' views.

"5. That in any reorganization of the Institute it should, except for the financial aid referred to above, be entirely independent of any level of Government.

"Please accordingly let me hear from you at your early convenience as to whether or not you believe that the conclusions referred to above would be satisfactory to the Engineering Institute."

Council instructed the general secretary to advise Mr. Bunnell that it supported the proposal which he had made.

New Engineering Organization—With regard to the proposal for a new engineering organization, which had been referred by Council to the Committee on Professional Interests for consideration and report, Mr. Stirling, as chairman of that committee, presented the following letter to the president:

"At a meeting of the Committee on Professional Interests on December 15th, 1944, provisional approval was given to the attached draft of a proposed declaration of the principles and policy of the Council of the Engineering Institute with reference to its relations to sister societies having membership in Canada.

"As per instructions of Minute No. 3463 of the Edmonton meeting of Council on October 21st, 1944, the draft is being submitted to the presidents and secretaries of the associations having agreements with the Institute.

"In view of the importance of this draft the committee suggests that you, as president, refer it to each past-president and to each member of Council with a request that he transmit to Headquarters his comments thereon not later than Monday, January 29th. Such comments as are received by that date will be collated by the Committee on Professional Interests with a view to a submission for consideration at the plenary meeting of Council in Winnipeg on February 6th next, the day prior to the opening of the fifty-ninth annual general meeting."

In accordance with Mr. Stirling's request the draft declaration referred to in the letter will be submitted by the president to each member of Council and to each past-president.

Co-operative Agreement in Quebec—The general secretary presented the following report from the scrutineers appointed by Council to canvass the ballots on the proposed co-operative agreement between the Institute and the Corporation of Professional Engineers of Quebec:

Ballot of Corporate Members:

Total number of Ballots received		836
In Arrears	31	
Invalid Ballots	12	
No	96	
Yes	697	
		836

Ballot-Councillors:

Total Ballots received	38
Yes	38

On the motion of Mr. Poitras, seconded by Mr. Eadie, it was unanimously resolved that the report be accepted, that the ballot papers be destroyed, and that the scrutineers be thanked for their services.

Through a letter from the president of the Corporation, it was noted that the Corporation had also recorded a favourable ballot, the details of which are as follows:

Total number of ballots received	1168
Ballots in favour	765

Ballots against	344
Ballots rejected	30
Ballots invalid	29
	—— 1168

In commenting on the very satisfactory results obtained, the president drew attention to the amount of work which Mr. Lalonde had done as chairman of the Institute's committee which had been working on this proposed agreement for over two years. On behalf of Council he thanked him most sincerely for his efforts.

On the motion of Mr. Heartz, seconded by Colonel Grant, the following resolution was passed unanimously:

"Council has noted with pleasure the results of the recent ballots on the proposed co-operative agreement between the Corporation of Professional Engineers of Quebec and the Institute, and it desires to record its appreciation of the efforts which have been put forward by Councillor J. A. Lalonde, who, for several years. has acted as chairman of the committee that has been fostering the proposal. Mr. Lalonde's efforts in bringing the subject so clearly before all the branches in the province, and his activity in obtaining a large return of ballots from Institute members, has been a great factor in producing the successful results. In acknowledging Mr. Lalonde's work Council feels that it is speaking, not only for its own membership, but for all engineers of the Province of Quebec.

"Council would be grateful to Mr. Lalonde if he would extend the Institute's appreciation to the members of his committee who assisted him in this project."

On the motion of Colonel Grant, seconded by Mr. McLeod, it was unanimously resolved that the president and the general secretary, or alternates appointed by the president, be authorized to sign the agreement between The Engineering Institute of Canada and the Corporation of Professional Engineers of Quebec.

The Council adjourned for lunch at one ten p.m., and reconvened at three o'clock with Vice-President L. F. Grant in the chair.

Automatic Transfer of Students and Juniors—Mr. Sills referred to a subject which the executive of the Peterborough Branch had brought to the attention of Council in 1943 relating to automatic transfer from Student to Junior. This proposal had been before Council previously and the general secretary had been asked to make a survey over the last five years in order to develop figures upon which a thorough study could be made. Mr. Sills had the general secretary's figures and now wished to bring the matter again to the attention of Council.

He explained that it was quite apparent that a great many persons delayed transferring to Junior until long after they had the qualifications. In this way the Institute was losing considerable revenue. His proposal was that Student members be transferred automatically at a certain specified period after graduation, without a transfer fee. Figures which he had developed showed that the increase in revenue from the earlier application of the Junior fee more than exceeded the loss of revenue from the cancellation of the transfer fee.

Mr. Sills pointed out, further, that his study revealed that applications for transfer from Student to Junior were almost never declined by Council. Therefore he felt that the transfer could be made without requiring a formal application for transfer with references, etc. He pointed out that the saving in work at Headquarters of following up delinquent Students would represent a considerable amount of money and would also relieve the Headquarters staff of a large volume of detail.

His proposal went on further to recommend that a person be allowed to remain in the Junior classification as long as he wished, but that after a certain specified period of time the fee would be increased automatically to that of Member. For a Junior to be transferred to Member it would be necessary for him to make an application in accordance with the present by-laws.

Mr. Sills did not make any specific recommendation as to the periods of time involved in these changes but submitted for consideration a suggestion that a person would be automatically transferred from Student to Junior either in the second or third January after graduation. This would mean approximately one and a half or two and a half years. He suggested that the period for which the Junior fee would apply might be somewhere from six to eight years. In the case of members who entered the Institute as Juniors a maximum age limit would have to be applied at which time they would have the same increase in fee as would apply to Juniors who had been transferred from Student.

The chairman observed that this was a far-reaching proposal and would require changes in the by-laws. After some discussion, Mr. Heartz moved that the proposal be referred to the Membership Committee and that the thanks of Council be extended to Mr. Sills for his proposal. He also proposed that Mr. Sills' name be added to the Membership Committee. This was carried unanimously.

Financial Statement—It was noted that the financial statement to the end of November had been examined and approved by the Finance Committee. It showed a considerably improved situation over last year.

Remission of Fees of Members in Combatant Areas—On the recommendation of the Finance Committee it was unanimously resolved that the annual fees of members in combatant areas be remitted for 1945, in accordance with the policy which had been adopted since 1941.

Institute Examinations—On the recommendation of the Finance Committee and the chairman of the Board of Examiners, it was agreed that the whole procedure regarding Institute examinations should be reviewed, including the charges for examination, the basis of remunerating the persons who prepare and examine the papers and the invigilators. It was also suggested that the list of recommended textbooks be brought up to date.

Alternative Proposal for Use of Institute Funds—The Finance Committee had read a letter from Professor R. F. Legget in which six suggestions were made as to purposes for which he thought Institute funds might be used to better advantage than to establish an office in Toronto for some one to take charge of the rehabilitation of members in uniform. The committee felt, however, that it could not alter its previous recommendations to Council but thought Professor Legget's letter should be brought to the attention of Council so that the secretary could be instructed as to a reply. Each of the proposals was discussed and the secretary was instructed as to the reply.

Increased Fees and Rebates—As an outcome of consideration of Professor Legget's letter and of Councillor Wilson's earlier observations relative to increased rebates to branches, Council discussed at length the prospect of increasing the annual fee of the Institute. It would not be possible to increase rebates to branches with the present fee basis without greatly reducing the activities of Headquarters. Mr. Armstrong, as a member of the Finance Committee, stated that the annual surplus, averaged over a period of years, was not sufficient to take care of increased rebates to branches and an increase of Headquarters activities.

Colonel Grant suggested that the Finance Committee might study this subject and make a report at a subsequent meeting.

On the motion of Mr. Heartz, seconded by Mr. Vance, it was agreed that the Finance Committee should endeavour to have a report on this subject ready for submission to the annual meeting of Council in Winnipeg on February 6th next.

Engineer in the Active Services—The general secretary reported that a letter had been sent for publication in *The Engineering Journal* by E. P. Muntz, M.E.I.C., in which the observation was made that in the present set-up at Ottawa in the Engineers' Corps there was no senior appointment available to engineers. The letter recommended that an engineer be appointed to the rank of Brigadier or Major-General who could act as a chief adviser on engineering matters, including personnel, to the Chief of General Staff. Such an appointment would place the engineers on a basis comparable to that established for the medical doctors. The general secretary explained that he was bringing the matter before Council so that consideration could be given to the desirability of transferring this matter to the Institute's Committee on the Engineer in the Active Services.

Colonel Grant stated that the general secretary had placed all the information before him the night previous, and that he had had some opportunity to familiarize himself with it. He thought that this afforded a further opportunity for the Institute to render a service to the profession. In view of the fact that the matter has been brought so forcibly to the Institute's attention he thought it would be a mistake not to follow up by means of the Institute's committee. He recommended, therefore, that it be referred to the committee and that the chairman, Dean D. S. Ellis, of Queen's, be asked to prepare a report for Council. On the motion of Mr. Eadie, seconded by Mr. Heartz, it was agreed that the subject be referred for further consideration to the president and the general secretary and that they be empowered to act on the recommendation of the committee.

Hamilton Branch By-laws—A letter was presented from the secretary of the Hamilton Branch asking Council's approval of a proposed amendment to the branch by-laws whereby the annual fee for a Branch Affiliate would be increased from $3.00 to $5.00. This is in accordance with a recommendation made some time ago by the Institute Membership Committee. On the motion of Mr. Vance, seconded by Mr. Armstrong, the proposed amendment to the branch by-laws was approved unanimously.

Keefer and Ross Medals—The general secretary reminded Council that in 1942 it was agreed that two new prizes should be created, one for papers on a civil engineering subject, to be known as the Keefer Medal in honour of the first president of the organization, and the other for an electrical paper, to be named the Ross Medal, in honour of Past-President R. A. Ross. He explained that these medals had never been awarded because of the difficulty of securing new dies. However, he recommended that awards be made this year even though the medals might not be available immediately. Council agreed to this unanimously, and the president was authorized to appoint two committees to make the selections.

Medal Committee Reports—The reports of the Gzowski, Leonard and Plummer Medal Committees were accepted, and awards were made as follows:

Gzowski Medal—To W. Griesbach, M.E.I.C., for his paper "Construction of Shipshaw Power Development."

Leonard Medal—To J. E. Gill and P. E. Auger for their paper "Zinc Deposits of the Federal Area."

Plummer Medal—To Wilfred Gallay for his paper "Plastics in Engineering."

The Leonard Medal Committee had suggested that as no award of that medal had been made last year, a second award should be made this year, and they had named a second paper. In view of the fact that two medals were required for the authors of the first paper, and as the proceeds from the fund would not warrant the awarding of two additional medals, Council decided to award two medals, one to each of the authors of the first paper as indicated above.

Students and Juniors Prizes—The reports of the examiners for the Students and Juniors Prizes were received, and awards were approved as follows:

H. N. Ruttan Prize (Western Provinces)—No award.

John Galbraith Prize (Province of Ontario) to A. Hershfield, S.E.I.C., for his paper "Plywood—A Structural Material for Aircraft."

Phelps Johnson Prize (Province of Quebec—English) —No award.

Ernest Marceau Prize (Province of Quebec—French) to Andre Leclerc, S.E.I.C., for his paper "Influence de la Vitesse d'essai sur la résistance."

Martin Murphy Prize (Maritime Provinces)—to J. L. Belyea, S.E.I.C., for his paper "The Cathode Ray Oscillograph and its Application in Industry."

The examiners for the Martin Murphy Prize strongly recommended a paper by F. W. Davidson, S.E.I.C., entitled "Principles of the Transformer," and Council agreed that this should be recorded in the minutes and that the president should write a letter of congratulation to Mr. Davidson.

Job Evaluation—Mr. Sills asked permission to bring up a subject about which Mr. G. R. Langley, of Peterborough, had written to the president early in the summer. It had to do with job evaluation for engineers. Mr. Langley has given a great deal of consideration to this subject and has prepared a synopsis of what he considers a reasonable job evaluation. In his opinion, before anything can be done in the way of collective bargaining, some basic value for jobs must be set up. This would have to be country-wide and would have to be done by some organization whose action would be authoritative. Mr. Sills had discussed the matter with Mr. Heartz, the chairman of the Institute's Committee on Employment Conditions.

Mr. Heartz stated that he had discussed this with an American firm of experts, considered to be outstanding on job evaluation and its related subjects. They admit that it is a very difficult problem, to which they have not yet found a satisfactory solution. While sympathetic to what Mr. Sills had said, Mr. Heartz did not think there was anything his committee could do at the present time.

Following some discussion, it was suggested that Mr. Langley and Mr. Sills might continue their study of this subject and submit some definite recommendations to Council. This was approved unanimously and the general secretary was directed to write Mr. Langley and ask if he would be willing to continue his investigation with this in view.

Joint Finance Committee in New Brunswick—It was noted that as the four members of the joint finance committee in New Brunswick had not selected a chairman within thirty days of their own appointment, in accordance with the terms of the co-operative agreement, President Beaubien had named V. S. Chesnut, of Saint John, as chairman of the committee.

A meeting of the Council of the Institute was held at Headquarters on Saturday, January 13th, 1945, convening at nine thirty a.m.

Present: President deGaspé Beaubien in the chair; Vice-President C. K. McLeod; Councillors J. E. Armstrong, R. S. Eadie, E. V. Gage, P. E. Gagnon, R. E. Heartz, J. A. Lalonde, H. J. Ward and J. W. Ward; Treasurer R. E. Chadwick; Secretary Emeritus R. J. Durley, General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

Employment Conditions (Collective Bargaining)—A letter dated January 9th, from Councillor P. E. Poitras, relative to the establishment of a collective bargaining agency in the province of Quebec was read to the Council. This letter reviewed some of the recent developments and concluded with the statement, "As a result the Quebec Federation of Employee-Professional Workers in Research and Applied Science is being organized."

Mr. Heartz reported that his committee had made a further study of the draft proposal for a collective bargaining agency in the province of Quebec and in accordance with the minutes of the last meeting of Council had reported to the president and the chairman of the Finance Committee. Though still unable to recommend the constitution, he reported that he had been in conversation with the chairman of the committee working on the proposal and he believed that it might be possible to have some modifications made that would meet the situation. He reported that further information had been received about the specific case which, at the last meeting of Council, was considered urgent, because of a reported attempt of a trade union to include engineers in a unit of heterogeneous employees which was being organized in Montreal, and he had found that the urgency had now been removed and that therefore in his opinion it was not necessary to rush the proposed organization.

He thought that it would be difficult to set up an organization or to prepare a constitution that would meet the needs until a final decision had been reached as to the form of the legislation under which engineers would have to bargain. Any constitution based on the existing order might be unsuitable for administration under the proposed new order, or any other arrangement decided upon by the Board.

Mr. Heartz then proceeded to report on the appearance made by the engineers before the Wartime Labour Relations Board (National) in Ottawa on January 9th. The fourteen societies were represented by the subcommittee which they had appointed, Messrs. MacRae, Dobson and Heartz, who presented a well prepared brief. He praised the presentation made by Mr. MacRae and expressed the opinion that the engineers handling their own case made a showing which did not suffer in comparison with that made by lawyers representing other groups.

He pointed out that there was opposition to the request for a new order. This came from the Canadian Congress of Labour (A.F. of L.), the Association of Technical Employees (C.I.O.), the Trades and Labour Congress of Canada, and the Canadian Association of Scientific Workers.

It was the opinion of the professional persons present at the sitting that the case put up by the opposition was weak. The trades union groups did not meet the specific statements made in the brief but resorted to references to democracy, class distinction, snobbery, and so on. The Association of Scientific Workers claimed to represent a professional group made up of science workers numbering perhaps two hundred to two hundred and fifty.

The Ontario Association of Professional Engineers and its collective bargaining organization known as The Federation of Employee-Professional Engineers and Assistants, also presented short briefs, but these were quite in line with representations made by the sub-committee of three and therefore it was evident to the Board that the professional workers were presenting a united front.

Mr. Heartz went on to state that a brief was presented by the Canadian Manufacturers Association which opposed the engineers' request for a new order and asked instead that they be given total exclusion from the existing order. No brief was presented by the Canadian Chamber of Commerce although they had an observer present.

An interesting feature was that the representative of the Canadian and Catholic Federation of Labour was of the opinion that if the professional people wanted to handle their own collective bargaining provincially they should be given the right to do so.

Mr. Heartz pointed out that the Conference of Canadian Universities was represented by Dean J. J. O'Neill, of McGill, who reported that the universities had secured a telegraphic vote on the question and that they asked that the professional employees of the universities be excluded from collective bargaining legislation.

Mr. Heartz then went on to discuss the possibility of success in obtaining new legislation. He pointed out that the opposition carried considerable weight and that the Board might offer a compromise proposition. He thought the Board recognized the difficulty of the problem before it, both from the point of view of giving the engineers what they required and from satisfying the trade union groups.

Mr. Heartz then went on to explain the steps that have been inaugurated since the appearance before the Board to secure support for the new order which, at the moment, he did not think should be publicized too widely. He concluded by requesting that his remarks be taken as a progress report and approved. He had also requested that he be empowered to continue discussions with the other persons and organization that were interested in the formation of a collective bargaining agency in the province. He would also like to have the brief which was presented to the Board approved by Council.

It was moved by Mr. Armstrong that Mr. Heartz's report be approved and that Council give a vote of confidence to Mr. Heartz and his committee. This was seconded by Mr. McLeod and carried unanimously.

Engineers and the Design of Buildings: The Finance Committee reported that further thought had been given to the necessity of clarifying the Quebec provincial legislation so that in the future there could be no doubt as to the engineers' right to continue to design industrial buildings. In order to establish this fact, which doubtless would include revision of the legislation, the committee thought that the engineers should consider the creation of a special fund.

Mr. Chadwick was of the opinion that decision as to future policy should await the decision of the court on the case of Brian Perry and the Quebec Association of Architects. He agreed with the necessity of having the legislation clarified and pointed out that this might require a lot of work, and that it might need the full time services of some competent person for a considerable period of time. He recommended that after the court decision had been made a group of engineers should get together to formulate the future policy.

Mr. Armstrong agreed with the suggestion that the formulation of a policy should be deferred until the court decision was made. He pointed out that the Institute's interest was not restricted to the province of Quebec and that it would have to be concerned along with the provincial associations in other provinces where similar conflict between architects and engineers might develop.

Council gave unanimous approval to the Finance Committee's recommendation.

Committee on Prairie Water Problems: On the recommendation of the chairman of the committee, G. A. Gaherty, it was unanimously resolved that C. S. Clendening and P. J. Jennings be appointed to the Committee on Prairie Water Problems.

Canadian Standards Association: A letter was read from the secretary of the Canadian Standards Association notifying Council that the term of office of its present representative on the Main Committee expires on March 31st, 1945, and asking for nominations for a representative for a further three year period. It was agreed that this matter should be brought before the next meeting of Council.

Committee on Soil Mechanics or Soil Tests: Mr. Chadwick reported that last fall the president had asked him to be chairman of a committee to carry out a certain task for Professor Terzaghi who was coming to Montreal to speak before the Montreal Branch. Dr. Terzaghi had asked for samples of certain clay found principally in the province of Quebec. He had arranged to have the samples secured and conveyed to Professor Terzaghi.

He now wished to point out to Council that there are many types of clay in Canada but that so far as he knew no scientific analysis had been made that would include them all. He knew that certain individuals in every province had a personal and practical knowledge of the local clay, but he thought an effort should be made to have them all classified in accordance with the new terminology developed under the heading of "Soil Mechanics". A national classification of this type, he believed, would be of considerable assistance to engineers inasmuch as a correct impression could be conveyed to engineers any place without the necessity of them seeing the clay deposits themselves. He pointed out the difficulty experienced by many persons making borings and test pits in recording their findings in such a way that they would be interpreted uniformly by all persons reading them.

He announced that he had suggested to Professor Legget of the University of Toronto that a course be established which might be attended by senior engineers in order to familiarize them with the subject of soil mechanics which had been developed in recent years. Professor Legget had approved of this suggestion and, as recently announced in the *Journ l*, arrangements had been made at the University of Toronto for this "refresher" course.

Mr. Chadwick recommended that the Institute set up a new committee or continue the temporary committee of which he had been chairman, so that the obtaining of the samples and the tests could be carried out on standard lines. He thought that the committee should include persons from each province whose companies, or who, individually, were specially interested in this subject. He believed there would be no difficulty in carrying out the work of the committee as long as care was taken to choose the right representatives across the country.

The president gave approval to Mr. Chadwick's suggestion and recommended that Council authorize the continuance of the existing committee, perhaps changing the name to Committee on Soil Tests as recommended by Mr. Chadwick.

Mr. Armstrong approved the proposal that Mr. Chadwick continue with the chairmanship, and that he be empowered to select his own committee, and to prepare the terms of reference.

Mr. Chadwick suggested that he might endeavour to get a group of interested engineers together during the course of the annual meeting so that the organization work could be prepared in time for the gathering of samples in the early summer.

ELECTIONS AND TRANSFERS

At the meeting of Council held on December 16th, 1944, the following elections and transfers were effected:

Members

Bach, James R., B.Sc. (Elec.), (Univ. of Manitoba), mgr., instrument divn., Sparton of Canada, Ltd., London, Ont.

Bissett, Ernest Eugène, B.Sc. (Mech.), (Univ. of Washington), consltg. engr., Vancouver, B.C.

Hueck, Baron Boris de, B.Sc. (Polytechnic Institute of Riga, Russia), chief engr., Canadian Cottons Ltd., Cornwall, Ont.

Isbester, James Emery, Capt., R.C.E., B.A.Sc. (Univ. of Toronto), Directorate of Works & Construction, National Defence Headquarters, Ottawa, Ont.

Laidrich, Edward, Mech. Engr. (Ecole Polytechnique Federale Suisse, Zurich), engr., Pacific Mills Co. Ltd., Ocean Falls, B.C.

Leblanc, Raymond Forté, B.A.Sc., M.E. (Ecole Polytechnique), B.Eng. & M.Eng. (McGill Univ.), M.Sc. (Univ. of Montreal), asst. prof. of mining engrg., Ecole Polytechnique, Montreal.

McCuaig, Donald Alexander, B.Sc. (Elec.), (Univ. of Manitoba), western district mgr., Ferranti Electric Ltd., Winnipeg, Man.

Morrison, David, (Borough Polytechnical Inst., London), chief engr., Kipp-Kelly Ltd. & consltg. engr., Ogilvie Flour Mills Co., western divn., Winnipeg, Man.

Peck, William Romaine, (Univ. of Toronto), chief dftsman., Ottawa Car and Aircraft Ltd., Ottawa, Ont.

Tallman, Esley Gordon, B.Sc. (Civil), (Univ. of Sask.), design engr., Hydro-Electric Power Commn. of Ont., Toronto, Ont.

Turner, William Elliott, B.A.Sc. (Univ. of Toronto), cost engr., Toronto Transportation Commn., Toronto, Ont.

Walsh, John Stanley, B.Sc. (Brighton Tech. Coll.), Naval Ordnance Inspecting Officer, B.A.T.M., Montreal area.

Juniors

Heys, Charles Horace, B.A.Sc. (Chem.), (Univ. of Toronto), mfg. engr., electronics divn., Northern Electric Co., Montreal.

Lefebvre, Jean Jules, B.A.Sc., C.E. (Ecole Polytechnique), instructor, dept. of hydraulics, Ecole Polytechnique, Montreal.

Affiliates

O'Connor, Patrick Arthur, Major, R.C.E., B.Sc. (F.), (Univ. of Toronto), District Engr. Officer, Military District No. 10, Winnipeg, Man.

Pickard, Norman Stanley, Major, R.C.E. (Res.), (Manchester Coll. of Technology), constrn. engr., Dept. of Munitions & Supply, Montreal.

Transferred from the class of Junior to that of Member

Byers, William Caryl, B.Sc. (Elec.) & B.Sc. (Civil), (Univ. of Manitoba), designing engr., C. D. Howe Co. Ltd., Port Arthur, Ont.

Kerry, Frank George, B.Eng. (McGill Univ.), Engr. (E.S.S.A., Paris), mgr., development & engrg. dept., Canadian Liquid Air Co. Ltd., Montreal.

Motherwell, James Shearer, Sqdn. Ldr., R.C.A.F., B.A.Sc. (Mech.), (Univ. of B.C.), Chief Engrg. Officer, No. 11 A.1. District, Montreal.

Transferred from the class of Student to that of Member

Gauthier, Raymond Claude, B.Sc. (Civil), (Univ. of Manitoba), asst. designer (reinforced concrete), Dominion Bridge Co. Ltd., Winnipeg, Man.

Harland, Robert Thompson, F/L., R.C.A.F., B.Sc. (Univ. of Manitoba), S.M. (M.I.T.), Radar Officer, R.C.A.F., Washington, D.C.

Mackinnon, Donald Laughlin, U/T Pilot, R.C.A.F., B.Sc., M.Sc. (Civil), (Univ. of N.B.), No. 12 S.F.T.S., R.C.A.F., Brandon, Man.

Roy, Phil, B.Sc. (Queen's Univ.), plant engr., Canadian Locomotive Co. Ltd., Kingston, Ont.
Swan, Andrew Munro, Elect. Lieut., R.C.N.V.R., B.Sc. (Elec.), (Univ. of Manitoba), Elect. Officer, Torpedo School, Halifax, N.S.

Transferred from the class of Affiliate to that of Member

Murray, William John, Capt., R.C.E., (A-5), C.E.T.C., Petawawa Military Camp, Petawawa, Ont.

Transferred from the class of Student to that of Junior

Bogle, Roy Thomas, Major, R.C.E.M.E., B.A.Sc. (Mech.), (Univ. of B.C.), Elect. & Mech. Engr., Directorate of Mech. Engrg., Ottawa, Ont.
Browne, Jack Wilkinson, B.Sc. (Elec.), (Univ. of Manitoba), asst. supt. of small arms ammunition group, D.I.L., Bouchard Works, Que.
Buchanan, James Charles, B.Sc. (Elec.), (Univ. of Sask.), tool engr., Hamilton, Ont.
Coutts, Erskine, B.Eng. (McGill Univ.), engr., Jas. Thom & Co. Ltd., genl. contractors, Montreal.
Dansereau, Joseph Hercule Rene, B.A.Sc., C.E. (Ecole Polytechnique), Navigation Instructor, R.C.A.F., Montreal.
Davies, Richard Llewelyn, B.Sc. (Civil), (Univ. of Alberta), res. engr., Dept. of Transport, Whitecourt, Alta.
deVillers, Raoul Albert, B.A.Sc., C.E. (Ecole Polytechnique), mech. engr., Canadian Marconi Company, Montreal.
Drouin, Jacques, B.A.Sc., C.E. (Ecole Polytechnique), oxy-cutters dept., Marine Industries, Ltd., Sorel, Que.
Dunbar, George G., B.Eng. (Chem.), (McGill Univ.), chemist, Imperial Oil Ltd., Dartmouth, N.S.
Dunn, Sydney Mewburn Secord, B.A.Sc. (Metallurgy), (Univ. of Toronto), supt. of quality control, D.I.L., Bouchard Works, Que.
Farago, William James, Lieut., R.C.E.M.E., B.Sc. (Mech.), (Univ. of Sask.), O.C., 119 L.A.D., R.C.E.M.E.
Garrett, Cyril, Elect. Lieut., R.C.N.V.R., B.Sc. (Univ. of Saskatchewan), Naval Research Establishment, H.M.C.S. Stadacona, Halifax, N.S.
Glynn, Walter S., B.A.Sc. (Univ. of Toronto), instructor in engrg. drawing, Univ. of Toronto, Toronto, Ont.
Haakonsen, Haakon, B.Sc. (Elec.), (Queen's Univ.), teacher of maths. & electricity, Shawinigan Technical Institute, Shawinigan Falls, Que.
Hall, William Francis, B.Sc. (Civil), (Univ. of Sask.), junior engr., P.F.R.A., Medicine Hat, Alta.
Huot, Joseph Adelard Marcel, F/L, R.C.A.F., B.A.Sc., C.E. (Ecole Polytechnique), Navigator & Navigation Instructor, R.C.A.F., St. Johns, Que.
Keyfitz, Irving M., B.Eng. (McGill Univ.), asst. to chief engr. & sales mgr., Canadian Propellers Ltd., Montreal.
Kirk, Jack Willsie, B.Sc. (Civil), (Queen's Univ.), field engr., International Water Supply, London, Ont.
Laberge, Paul X., B.A.Sc., C.E. (Ecole Polytechnique), plant engr., Donohue Bros., La Malbaie, Que.
Lecavalier, Fernand, F/O, R.C.A.F., B.A.Sc., C.E. (Ecole Polytechnique), B.S., Aero Engrg., (M.I.T.), Engrg. Officer, R.C.A.F., Debert, N.S.
Normandeau, J. Gilles Laurent, B.A.Sc., C.E. (Ecole Polytechnique), shipbuilding engr., Marine Industries, Ltd., Sorel, Que.
Palmquist, David Ernest, Elect. Sub. Lieut., R.C.N.V.R., B.Sc. (Elec.), (Univ. of Manitoba), M.E.E. Dept., H.M.C.S. Scotian, Halifax, N.S.
Peabody, Gerald S., B.Sc. (Elec.), (Univ. of N.B.), service engr., Canadian Westinghouse Co., Montreal.
Pratt, James Crawford, Elect. Lieut., R.C.N.V.R., B.S. (Elec.), (Univ. of Manitoba), Elect. Officer, Naval Research Establishment, Halifax, N.S.
Proulx, Gilbert, B.A.Sc., C.E. (Ecole Polytechnique), asst. supt., Saguenay Electric Co., Chicoutimi, Que.
Rolland, Lucien Gilbert, B.A.Sc., C.E. (Ecole Polytechnique), plant engr., Rolland Paper Co. Ltd., Mont-Rolland, Que.
Roue, John Edward, Acting Elect. Lt. Cmdr., R.C.N.V.R., B.Eng. (Elec.), (N.S. Tech. Coll.), Chief Radio Engrg. Officer, R.C.N.V.R., H.M.C. Dockyard, St. John's, Nfld.
St. Jacques, Maurice, B.A.Sc., C.E. (Ecole Polytechnique), fractional horsepower motor engr., Cdn. General Elec. Co. Ltd., Peterborough, Ont.
Scott, Richard, B.A.Sc. (Elec.), (Univ. of Toronto), instructor in elec. engrg., Univ. of Toronto, Toronto.
Skelton, Eric Tudor, Lieut., R.C.E., B.Sc. (Civil), (Univ. of N.B.), Platoon & Section Cmdr., 27th Gen. Pioneer Coy., R.C.E., Montreal.
Staniforth, Harold F., F/L, R.C.A.F., B.Eng. (Mech.), (McGill Univ.), Aeronautical Engineer, R.C.A.F., Ste. Genevieve, Que.
Stephenson, Eric Paul, Major, R.C.E.M.E., B.Eng. (Elec.), (N.S.Tech.Coll.), Acting Major, Directorate of Mech. Engrg., Ottawa, Ont.
Sutton, Arthur Leslie, B.A.Sc. (Elec.), (Univ. of B.C.), application engr., English Electric Co. of Canada, St. Catharines, Ont.
Tetreault, Armand Jean, B.A.Sc., C.E. (Ecole Polytechnique), inspecting officer, Inspection Bd. of United Kingdom & Canada, Ottawa, Ont.
Tetreault, Jacques, B.A.Sc., C.E. (Ecole Polytechnique), designer, German & Milne, Naval Architects, Montreal.
Waldron, John Ross, Lieut., R.C.E.M.E., B.Sc. (Elec.), (Univ. of Manitoba), Elec. & Mech. Engr., (Radar) Army, No. 6 Coy., R.C.E.M.E., Sydney, N.S.
Ward, Kenneth Roy, Major, R.C.E.M.E., Grad. (R.M.C.), Kingston, Ont.
Webster, Geddes Murray, B.Eng. (McGill Univ.), foreman, operating dept., Nylon divn., C.I.L., Kingston, Ont.
Wilson, Murray Edgar, B.Sc. (Elec.), (Univ. of N.B.), elec. dftsman., Atlantic Region, C.N.R., Moncton, N.B.

Students Admitted

Bamford, Alfred Basil, (Univ. of Manitoba), 459 Waverley St., Winnipeg, Man.
Bourgault, J. A. Gerard, Sorel Industries Ltd., Sorel, Que.
Guard, Donald E., (Univ. of Manitoba), 466 Beaverbrook St., Winnipeg, Man.
Woolfrey, George Raymond, (N.S.Tech.Coll.), Pine Hill Residence, Halifax, N.S.

Students at Queen's University

Adams, Garnet David, 196 University Ave., Kingston, Ont.
Alexander, Samuel James, 64 Regent St., Kingston, Ont.
Bauman, Desmond A., 75 Alfred St., Kingston, Ont.
Beamish, Vincent A., Merrickville, Ont.
Bennett, James Metcalfe, Campbellford, Ont.
Birks, William Robert, 343 Frontenac St., Kingston, Ont.
Browning, Douglas R. S., Cardinal, Ont.
Campbell, Donald Ross, 37 Pembroke St., Kingston, Ont.
Conway, John Maxwell, 382 Earl St., Kingston, Ont.
Craig, Donald Spence, Ridgetown, Ont.
Creed, Frank C., 2282 Lincoln Road, Walkerville, Ont.
Darling, Ralph Gifford, 303 University Ave., Kingston, Ont.
Elliott, S. H. Mackenzie, 30 Bruton St., Port Hope, Ont.
Geddes, Walter Robert, 14 Upper William St., Kingston, Ont.
Gramoli, Louizio, 329 Earl St., Kingston, Ont.
Hanna, John Newton, Supt.'s Residence, Ontario Hospital, Brockville, Ont.
Harvey, John Arthur, 34 Wellington St., Kingston, Ont.
Hope, Robert Leslie, 329 Earl St., Kingston, Ont.
Horricks, Robert, 530 River Road, Pembroke, Ont.
Jarvis, James Gordon, 164 Barrie St., Kingston, Ont.
Lamont, Donald Alexander, Morrisburg, Ont.
Lea, Edgar Robert, 629 Johnson St., Kingston, Ont.
Lee, Frank B., 136 Hawthorne Ave., Ottawa, Ont.
Leon, Clifford Ernest, 128 Union St., Kingston, Ont.
Maguire, Robert Adam, 75 L. Alfred St., Kingston, Ont.
McKnight, Russell Melvin, 19 Aberdeen Ave., Kingston, Ont.
Moore, Arthur Donald, 234 Earl St., Kingston, Ont.
Moro, Sylvano B., 73 Division St., Kingston, Ont.
Nash, Philip Townsend, 186 Frontenac St., Kingston, Ont.
Ness, Arthur Franklin, 374 Earl St., Kingston, Ont.
Offer, Leslie Douglas, 72 Princess Ave., Leamington, Ont.
Payne, Joseph Murray, 165 Division St., Kingston, Ont.
Quance, Richard Albert, 81 Clergy St. West, Kingston, Ont.
Randall, Norman, 623 Johnson St., Kingston, Ont.
Richardson, K. Grant, 28 Brighton Ave., Woodroffe, Ont.
Robson, James Albert, 382 Carl St., Kingston, Ont.
Scott, James Blair, 382 Earl St., Kingston, Ont.
Secord, Lloyd Calvin, 583 Johnson St., Kingston, Ont.
Sheffield, Harvey Clifton, Lyndhurst, Ont.
Smoke, Franklin G., 81 Clergy St. West, Kingston, Ont.
Stewart, Robert William, 329 Earl St., Kingston, Ont.
Trewartha, Frank E., 76 Division St., Kingston, Ont.
Van Patter, Douglas Macpherson, 374 Earl St., Kingston, Ont.
Walker, Edward Arthur, 295 Alfred St., Kingston, Ont.
Walter, Herman Karl, c/o Queen's Univ., Kingston, Ont.
Whiteman, Raymond Henry, 599 Helen St., Port Arthur, Ont.
Wilson, Hugh William, Alvinston, Ont.
Woolsey, Edgar Garnet, 311 Queen St., Kingston, Ont.

Students at the University of British Columbia

Bakewell, David Reginald, 3531 West 33rd Ave., Vancouver, B.C.
Bayly, Lemuel James, Williams Road, Chilliwack, B.C.
Currie, Robert Henderson, 7610 Cartier St., Vancouver, B.C.
Dimock, Arthur Clarence, Smithers, B.C.
Ellis, Gordon McLean, c/o Univ. of B.C., Vancouver, B.C.
Gallaher, Ernest Eugène, 25 E. 48th Ave., Vancouver, B.C.
Golcman, Robert, 974 West 16th Ave., Vancouver, B.C.
Heal, Douglas Gordon, 3165 Capilano Road, North Vancouver, B.C.

Kolbeins, Henry, 584 West 16th Ave., Vancouver, B.C.
Lloyd, William Ernest, Mt. Tolmie P.O., Victoria, B.C.
Munroe, Lawrence Robertson, 4618 West 12th Ave., Vancouver, B.C.
O'Neil, William James, 4198 Angus Drive, Vancouver, B.C.
Peatfield, John H., 4624 West 10th Ave., Vancouver, B.C.
Robertson, Edward Alistair, 984 West 20th Ave., Vancouver, B.C.
Teevan, James T., 1785 West 12th Ave., Vancouver, B.C.

Students at McGill University

Boucley, Roger P., 4314 Bourbonniere Ave., Montreal.
Dohan, John Timmins, 327 Redfern Ave., Westmount.
Heuser, Eric Richard, 4056 Melrose Ave., Notre Dame de Grace, Montreal.
Love, Donald D., 1340 Regent Road, Town of Mount Royal, 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

Transferred from the class of Student to that of Member

McKay, William Gordon, B.Sc. (Civil), (Queen's Univ.), district engr., Department of Pensions and National Health, Edmonton, Alta.

Transferred from the class of Student to that of Junior

Mitchell, Maurice Stephen, B.Sc. (Civil), (Univ. of Alta.), instructor, dept. of civil engrg., Univ. of Alta., Edmonton, Alta.

SASKATCHEWAN

Junior

Milne, John Reid, B.Sc. (Civil), (Univ. of Sask)., junior engr., P.F.R.B., Dept. of Agriculture (Canada), Regina, Sask.

Students

Anderson, Cecil George, (Univ. of Sask.), 847 Temperance St., Saskatoon, Sask.
Dusel, Frank Joseph, (Univ. of Sask.), Y.M.C.A., Saskatoon, Sask.
Graham, Harry Marker, (Univ. of Sask.), 1125 Temperance St., Saskatoon, Sask.

Transferred from the class of Student to that of Member

Vance, Fenton Russell, B.Sc. (Elec.), (Univ. of Manitoba), traffic engr., Sask. Govt. Tels, Regina, Sask.

NOVA SCOTIA

Members

Brown, Edward Dow, B.Sc. (Elec.), (N.S.Tech.Coll.), plant supt., Canadian Industrial Minerals, Ltd., Walton, N.S.
Macdonald, John Angus, elec. supt., Dominion Iron and Steel Corpn., Sydney, N.S.

Transferred from the class of Junior to that of Member

Kline, Joseph Douglas, B.Eng. (Civil), (N.S.Tech.Coll.), design supervisor, Halifax Public Utilities Commn., Halifax, N.S.

At the meeting of Council held on January 13th, 1945, the following elections and transfers were effected:

Members

Blaylock, Selwyn Gwillym, B.A.Sc. and LL.D. (McGill Univ.), and LL.D. (Univ. of Alberta), chairman and president, Consolidated Mining & Smelting Co. of Canada, Ltd., Trail, B.C.
Cadario, Harry Paul, B.Sc. (Elec.), (Queen's Univ.), Major, D.M.E., N.D.H.Q., Ottawa, Ont.
Clarke, Ross Eugene, B.Sc. (Civil), (Queen's Univ.), res. engr., Dept. of Transport, Air Services Airport Constrn., Kingston, Ont.
Colls, Edward Arthur Geoffrey (Univ. of Sheffield), genl. supt., chem. and fertilizer dept., Consolidated Mining & Smelting Co. of Canada, Ltd., Trail, B.C.
Foss, Leiv, C. E. (Royal Inst. of Tech., Trondhjem), design engr., Foundation Co. of Canada, Ltd., Montreal.
Hutchison, William Leslie, B.Eng. (McGill Univ.), genl. supt., Hamilton Bridge Co. Ltd., Hamilton, Ont.
Lyman, Stephen M., Diploma (R.M.C.), B.Eng. (McGill Univ.), asst. project engr., industrial engrg. section, C.I.L., Montreal.
Turcke, Edmund Wolfgang John, C.E. (Swiss Federal Inst. of Tech., Zurich), structl. design engr., A. Surveyor & Co., Montreal.

Juniors

Hewitt, Harry Naylor, B.Sc. (Chem.), (Univ. of Alberta), asst. chief chemist, D.I.L. Bouchard Works.
Staples, William J., B.A.Sc. (Univ. of Toronto), mtce. engr., Aluminum Co. of Canada, Arvida, Que.
Tilbury, Harry C., Sub. Lieut. (E) (T), R.C.N.V.R., Hamilton, Ont.

Affiliates

Hawkins, Stuart Schofield, B.Sc. (Arch.), (McGill Univ.), Capt., R.C.E., Works Officer, M.D. 4, Montreal.
Willis, W. Paul R., tech. sales representative, Canadian Genl. Electric Co. Ltd., London, Ont.

Transferred from the class of Junior to that of Member

Giauque, Louis Frederick, B.Eng. (Mech.), (Univ. of Sask.), foreman, screen bar dept., The B. Greening Wire Co. Ltd., Hamilton, Ont.

Transferred from the class of Student to that of Member

Lafontaine, Daniel Joseph, B.Sc. (Queen's Univ.), chief engr., Electric Tamper & Equipment Co. of Canada, Ltd., Montreal.

Transferred from the class of Student to that of Junior

Courtright, James Milton, B.Sc. (Civil), (Queen's Univ.), lubrication engr., Shell Oil Co. of Canada, Ltd., Toronto, Ont.
Etkin, Bernard, B.A.Sc. (Univ. of Toronto), lecturer, Faculty of Applied Science, Univ. of Toronto, Toronto, Ont.
Griesbach, Robert Johnston, B.Eng. (McGill Univ.), designing engr., Foundation Co. of Canada, Ltd., Montreal.
Harvie, John Duncan, B.Sc. (Univ. of Man.), engr., Imperial Oil Ltd., Norman Wells, N.W.T.
Harvie, Thomas Allan, Flt. Lieut., R.C.A.F., Overseas.
Kraft, Robert William, B.Sc., M.Sc. (Queen's Univ.), chemist, Aluminum Co. of Canada, Ltd., Arvida, Que.
Latreille, André, B.A.Sc., C.E. (Ecole Polytechnique), civil engr. and estimator, Atlas Constrn. Co. Ltd., Montreal.
Lebel, Marcel, B.A.Sc., C.E. (Ecole Polytechnique), soils engr., Dept. of Roads, Quebec, Que.
MacBride, James Malcolm, B.Sc. (Civil), (Univ. of N.B.), asst. engr., C.P.R., Montreal.

Admitted as Students

Bishop, Keith Clement (N.S. Tech. Coll.), 40 Brenton St., Halifax, N.S.
Cepella, Otto Mario (McGill Univ.), 7959 de l'Epee Ave., Montreal.
Corbin, Terrance Lewis, 2nd Lieut., R.C.E., B.Eng. (Civil), (N.S. Tech. Coll.), A-5, C.E.T.C., Officers' Mess, Petawawa, Ont.
Fainstat, Michael M., 2nd Lieut., R.C.E.M.E., B.Eng. (McGill Univ.), Officers' Mess, A-21, C.O. & E.M.E.T.C., Barriefield, Ont.
Haskim, Robert (McGill Univ.), 6960 Sherbrooke St. West, Montreal.
Jackson, Robin Russell, B.Sc. (Elec.), (Univ. of Alberta), 489 King St., Peterborough, Ont.
Keeley, Henry, B.Sc. (Mech.), (Univ. of Sask.), 334 George St., Peterborough, Ont.
Lee, William U. (McGill Univ.), 1162 St. Urbain St., Montreal.
McKay, Donald Edgar Anderson (McGill Univ.), 3473 University St., Montreal.
Norman, Arthur W. (N.S. Tech. Coll.), 9 Tower Road, Halifax, N.S.
Petruchick, John Charton (McGill Univ.), 3892 Colonial Ave., Montreal.
Verdier, Henrik, Lieut. (SB) (E), R.C.N.V.R., H.M.C. Dockyard, Esquimalt, B.C.
Wood, E. Oren (Univ. of Man.), Ladywood Apts., 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:

SASKATCHEWAN

Students

Brandlmayr, John, Jr., 816 Ave. "J" South, Saskatoon, Sask.
Dickinson, John Grant, 323-3rd Ave., North, Saskatoon, Sask.
Feldman, David, 533-3rd Ave., North, Saskatoon, Sask.
Ludwig, Roy Edward, 317-9th St., East, Saskatoon, Sask.
McIntyre, Duncan, 1227 Elliott St., Saskatoon, Sask.
Mills, Robert Vincent, 620-9th Ave., Saskatoon, Sask.
Reeder, Wesley Foster, 1001-12th St., East, Saskatoon, Sask.
Rowbotham, Brien Howard, 508 Sask. Crescent, Saskatoon, Sask.
Smith, Thomas Rutherford, 503 Dufferin Ave., Saskatoon, Sask.
Snow, Alfred Harold Grant, 862 Sask. Crescent, Saskatoon, Sask.
Topham, Harvey Lawrence, St. Andrew's College, Saskatoon, Sask.

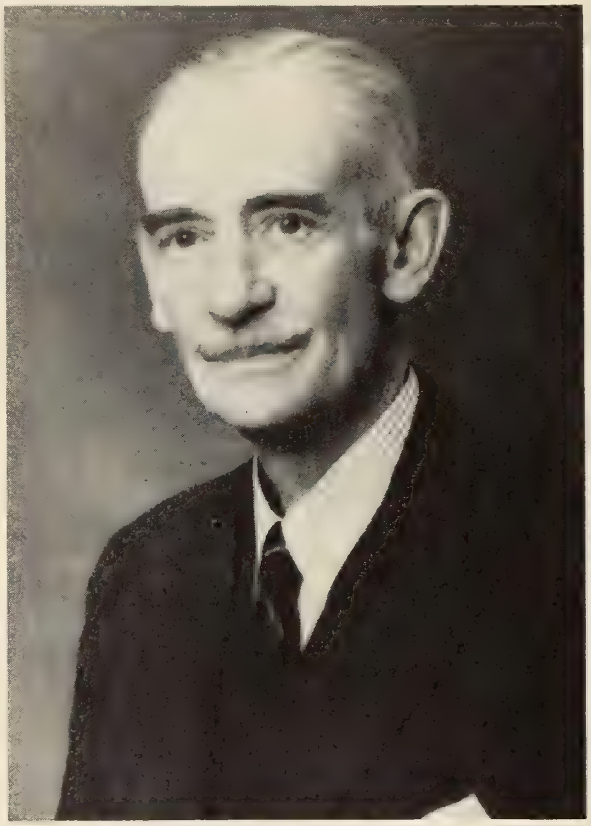
EDWARD PHILLIPS FETHERSTONHAUGH

PRESIDENT OF THE ENGINEERING INSTITUTE OF CANADA, 1945

It is appropriate, that as this year's Annual General Meeting takes place in Winnipeg, the duties of president of the Institute should be taken up by a distinguished Winnipeg member who is also the Dean of Engineering and Architecture at the University of Manitoba. During his professorship, and particularly since his appointment as head of the Engineering Faculty, Dean Fetherstonhaugh has been a leading figure in the development of engineering education in the prairie provinces. He is in fact the seventh dean of an Engineering faculty to occupy the presidential chair of the Institute.

His teaching and administrative work at the University was interrupted from 1914 to 1919 by a period of active service as an engineer officer in France and Belgium. He was demobilized with the rank of Major, his services in the field having been recognized by an award of the Military Cross, and by mention in despatches.

Our new president is not a native of the west. He is one of the dwellers in Manitoba who have forsaken their homelands in the east, and have migrated to those wider horizons which exist west of the Great Lakes. It may be that some day scientific investigation will reveal the exact nature of the potent attractive force which these regions seem to exert on young men of talent in the east. Till then one can only speculate, and perhaps assign as a contributory cause the dry and invigorating nature of Winnipeg's winter climate. But there is no doubt as to the importance of the part which so many of these immigrants have taken in the cultural development of the lands of their adoption.



E. P. Fetherstonhaugh, M.C., B.Sc., M.E.I.C.

Edward Phillips Fetherstonhaugh was born in Montreal in 1879, receiving his education in the High School there, and at McGill University, where he graduated in 1899 with honours in Electrical Engineering.

For the next four years he was associated with Fetherstonhaugh and Co., patent solicitors, as manager of their Ottawa office. While in Ottawa he held a commission in the Ottawa Field Company, Royal Canadian Engineers, thus commencing the military career in which he was later to distinguish himself.

Returning to McGill for two sessions, first as a demonstrator and then as a lecturer, he pursued further studies in 1905 and 1906. Then, like his predecessor in the chair of the Institute, he received much of his early engineering experience in the Pittsburgh shops of the Westinghouse Electrical and Manufacturing Company, whose service he entered in 1907, coming to their Winnipeg office as electrical engineer.

In June, 1909, he was appointed to the newly established chair of Electrical Engineering at the University of Manitoba, undertaking the responsible task of equipping the laboratories and organizing the work of the Department. On the opening of hostilities in 1914 he was made a member of the University's Committee on Military Education and was active in the formation of a contingent of the Canadian Officers Training Corps at the University.

Proceeding overseas in 1915, he served with the Canadian Engineers in France and Belgium, first as a Lieutenant in the First Field Company, then for a few months as Adjutant of the 1st Divisional Engineers, and later as Field Engineer for Defences under the Chief Engineer of the Canadian Corps, with the rank of Major. After the Armistice, he made a defence reconnaissance with the Chief Engineer of the 2nd Army, dealing with the bridgehead areas at Cologne and Bonn.

After his return to Canada, he was appointed Dean of Engineering in 1921, when separate faculties of the University of Manitoba were organized. He subsequently became Dean of Engineering and Architecture. In 1923 he took over the command of the University of Manitoba C. O. T. C. and was promoted to the rank of Lieutenant-Colonel. He relinquished the command in 1929.

As a consulting engineer, Dean Fetherstonhaugh has made many reports, investigations, and plans for the Dominion and provincial governments, as well as for municipalities and private concerns in western Canada. Among these activities may be mentioned his membership on a board of three engineers appointed in 1923 to report on the engineering and economic aspects of the Manitoba Power Commission's system, and his appointment in 1929 jointly by the City of Winnipeg and the Winnipeg Electric Company as chairman of a board of three members to study the problem of electrolysis and soil corrosion of underground water pipes. In this connection he attended a conference in 1937 at the Bureau of Standards, Washington, D.C., and presented a paper on underground corrosion.

Since 1937, he has been a member of the National Research Council of Canada, attending all its meetings and many meetings of its subcommittees. He has served on the Main Committee of the Canadian Engineering Standards Association since 1921, and also on its Electrical Sectional Committee and the Provincial Sub-Committee for Manitoba.

He has also served on a number of government and public boards and directorates, including the Advisory Board of the Royal Military College (1931 to 1935), and the Board of Trustees of the Winnipeg General Hospital (1923 to 1936). In the summer of 1941, he was Director of the Radio Technicians' Course given at the University of Manitoba for over two hundred members of the Royal Canadian Air Force.

He joined The Engineering Institute of Canada as a Student in 1899, becoming an Associate Member in 1908, and a Member in 1920. He was chairman of the Winnipeg Branch in 1921, and served on the Council from 1923 to 1925. He has been an Associate Member of the American Institute of Electrical Engineers since 1909. He became a registered member of the Association of Professional Engineers of the Province of Manitoba at its formation.

As teacher and administrator Dean Fetherstonhaugh has won the esteem and confidence of the long series of students who have received their professional schooling under his direction. His acceptance of the new office brings to the presidency of the Institute a man of high professional standing, of whom the Province of Manitoba and its engineers of all branches may well be proud. His appointment will be heartily welcomed by all the members of the Institute who have been privileged to know him.

—R.J.D.

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 a basis of personal items in the *Journal*.

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 List. There are 16 persons included in the lists printed in the newspapers which we believe are complete.

The Institute joins with the other citizens of Canada in congratulating the following members for the honours which they have so well deserved.

COMMANDER, ORDER OF THE BATH

Air Vice-Marshal Alan Ferrier, M.C., former member of Air Council, Department of National Defence, Air Service, now member of Air Transport Board, Ottawa, Ont.

OFFICER, ORDER OF THE BRITISH EMPIRE (O.B.E.)

Commander K. S. MacLachlan, R.C.N.V.R., former Deputy Minister for Naval Services, Montreal, Que.
Col. W. G. Swan, D.S.O., Croix de Guerre, R.C.E., Vancouver, B.C.
Lieut.-Col. William D. Kirk, R.C.A., Montreal, Que.
Lieut-Col. John M. Cape, R.C.A., Montreal, Que.
Group Capt. M. M. Hendrick, R.C.A.F., Toronto,Ont.

MEMBER, ORDER OF THE BRITISH EMPIRE (M.B.E.)

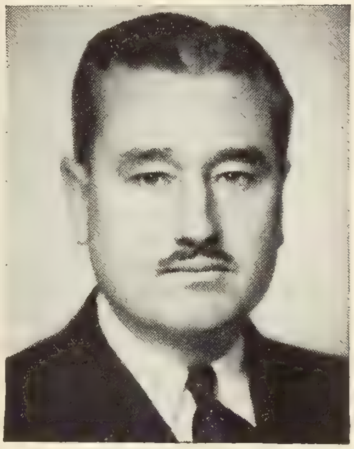
Major John D. Duncan, R.C.C.S., Toronto, Ont.
Major R. H. Wallace, R.C.A., Cardinal, Ont.
Major C. B. Bate, M.C., D.C.M., R.C.E., Quebec, Que.
Major L. D. McGee, R.C.O.C., Kitchener, Ont.
Sqd. Ldr. R. A. McLellan, R.C.A.F., Ottawa, Ont.
Capt. D. H. Forster, R.C.E.M.E., Sudbury, Ont.

MENTIONED IN DISPATCHES

Group Capt. Edward C. Luke, R.C.A.F., Vancouver, B.C.
Wing Commander J. L. Gray, R.C.A.F., Vancouver, B.C.
Sqd. Ldr. G. C. Brown, R.C.A.F., Montreal, Que.

KING'S COMMENDATION FOR VALUABLE SERVICES IN THE AIR

Sqd. Ldr. George Ross, R.C.A.F., Edmonton, Alta.



Gordon D. Hulme, M.E.I.C.

Gordon D. Hulme, M.E.I.C., has been appointed manager of the Public Relations and Advertising Department of The Shawinigan Water and Power Company in Montreal. He was successively assistant to the superintendent of transmission lines and assistant manager, Department of Development.

Gustave St. Jacques, M.E.I.C., has been appointed executive assistant to the Associate Transit Controller in the Department of Munitions and Supply. Mr. St. Jacques, who was formerly an engineer in the Public Service Board of the Province of Quebec at Quebec City, has now taken up residence in Montreal. Until his recent appointment he was secretary-treasurer of the Quebec Branch of the Institute.

Lieut.-Col. A. B. Dove, R.C.E., of Montreal, Que., and **Lieut.-Col. John M. Cape,** R.C.A., of Cartierville, Que., have been awarded the Canadian Efficiency Decoration as announced recently by the Department of National Defence.

A. G. Graham, M.E.I.C., senior assistant engineer for the past three years in the Construction Engineering Branch, Western Air Command, R.C.A.F., Vancouver, B.C., has been released to take a position in Victoria, B.C., as supervisor of regional planning connected with the rehabilitation and reconstruction schemes of the Province of British Columbia. Before joining the

Western Air Command, he was city engineer of the City of Nanaimo, B.C., for 12 years.

A. D. Ross, M.E.I.C., who has been with the Canadian Comstock Company Limited for eighteen years, the last thirteen as manager, has severed his connection with the firm to found his own business. The new firm will be known as A. D. Ross and Company, electrical engineers and contractors, with offices in Montreal. Mr. Ross holds the degree of Master of Science from the Massachusetts Institute of Technology and has had more than 20 years' experience in the electric contracting field.

Capt. R. T. Hollies, M.E.I.C., has recently returned to Canada from the northwestern European front. He has been discharged from the Army and has resumed his duties as superintendent of Glenmore Water Supply for the City of Calgary.

K. Winslow, M.E.I.C., of the Aluminum Company of Canada Ltd., has been transferred from Kingston, Ont., where he was plant engineer to the sales department in the Montreal office.

John B. Stirling, M.E.I.C., is the newly elected chairman of the Montreal Branch of the Institute. Born at Dundas, Ont., Mr. Stirling graduated from Queen's University as a Bachelor of Arts in 1909 and as a Bachelor of Science in 1911. After graduating he worked on municipal construction projects and during the last war served with the Canadian Expeditionary Force overseas in the Royal Canadian Engineers. He had been associated with E. G. M. Cape and Company, engineers and contractors, for several years, first as a field engineer and then as a supervising engineer. In 1928 he became a partner in the firm and later was made vice-president in charge of operations. He had 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.

W. H. Stuart, M.E.I.C., who joined the R.C.A.F. in 1940, has received his discharge and is now manager of the Halifax branch of War Assets Corporation. Before the war he was a construction contractor on government work in the national parks of Prince Edward Island and Cape Breton. From 1941 to 1944 Mr. Stuart was manager of the Stanley Flying Training School in Nova Scotia, which school was operated for the R.C.A.F. under the British Commonwealth Air Training Plan and which has been closed as a result of the curtailment of flying training.

Frederick Alport, M.E.I.C., engineer with the Department of Public Works of Canada, who was loaned to the Department of National Defence in June 1940, returned to his former position recently. His first position in the Naval Service was that of liaison officer. Upon formation of the Works and Buildings branch he was appointed district engineer at Halifax, N.S., which position he held until the end of 1942. In 1943 he was consulting engineer to Naval Service at Ottawa and is still available to that Department in this capacity.

Robert A. Logan, M.E.I.C., who had been serving as lieutenant-colonel in the United States Army, has been discharged due to permanent physical disability resulting from injuries received while on active service in the South Pacific.

Lester McGillis, M.E.I.C.

Lester McGillis, M.E.I.C., has been appointed manager of the Industrial Development Department of The Shawinigan Water and Power Company. His headquarters will be in Montreal. He was formerly manager of the Beauharnois Division of the Commercial and Distribution Department of the company at Valleyfield, Que.

J. E. A. Dugas, M.E.I.C., who has been employed by the R.C.A.F. for the past three years at No. 3 Training Command Headquarters, construction and engineering division, has returned to his former position as industrial engineer with the Quebec Hydro-Electric Commission at Montreal, Que.

Jean Asselin, M.E.I.C., former city manager of the City of Three Rivers, Que., has been engaged by the Public Works Department of the City of Montreal, in connection with its post-war planning programme.

Robert W. Ross, M.E.I.C., is now engineer, maintenance of way, with the Canadian National Railways (Western Division) at Winnipeg, Man.

H. G. O'Leary, M.E.I.C., has retired from his position as superintendent with the Canadian National Railways at Fort William, Ont., after several years' service. He has been engaged in railway work since 1904 and has held the above position since 1927.

R. R. Collard, C.B.E., M.E.I.C., who has been serving as Air Vice-Marshal, Director of Works and Buildings at R.C.A.F. Headquarters, Ottawa, is now with the Commonwealth Construction Company Limited at Winnipeg, Man.

Gilbert H. Bancroft, M.E.I.C., who has been with the Consolidated Mining and Smelting Company of Canada Limited at Trail, B.C., has accepted the position of chief engineer with Engineering & Machinery Limited at Vancouver, B.C.

Lawrence O. Cooper, M.E.I.C., has recently retired from the R.C.A.F. and has accepted the position of general superintendent of plant maintenance and construction with the Canadian Johns-Manville Company Limited, at Asbestos, Que.

J. G. Lefrançois, M.E.I.C., is now employed with Vipond-Tolhurst Limited at Montreal as combustion engineer. He was formerly with Volcano Limited.

J. L. Bieler, M.E.I.C., is now with Robert A. Rankin and Company, consulting industrial engineers at Montreal, Que. He was formerly employed in the engineering department of Williams and Wilson Limited at Montreal.

George N. Scroggie, M.E.I.C., junior engineer in the London District office of the Department of Public Works of Canada, has been promoted to the position of assistant engineer.

Rodney Bruce, M.E.I.C., of the Canadian Industries Limited, has recently been transferred from Brownsburg, Que., to the head office in Montreal.

Alexander Wilson, M.E.I.C., of the Canadian Comstock Company Limited, has been transferred from Toronto, Ont., to Montreal, Que.

Albert E. Chard, Jr.E.I.C., is at present employed as draughtsman with the Powell River Company at Powell River, B.C.

Earl A. Russell, Jr.E.I.C., of Defence Industries Limited, has been transferred from Nobel, Ont., to Chalk River, Ont.

Allan Pollock, Jr.E.I.C., is now employed on production development with the Office Specialties Company in Newmarket, Ont.

C. N. King, Jr.E.I.C., who has been serving overseas with the R.C.A.F. has been discharged and is returning to his former position in the engineering department of the Aluminum Company of Canada Limited at Montreal, Que.

Harry E. G. Dupuy, S.E.I.C., has recently been appointed manager of the Winnipeg Office of Babcock-Wilcox and Goldie-McCulloch, Limited. He was formerly service engineer and has been connected with the firm since 1938.

Robert Boyd, S.E.I.C., who has been employed by the Dominion Rubber Company Limited at St. Jerome, Que., has accepted a position as relay engineer with the Quebec Hydro-Electric Commission at Montreal.

G. Robert Edwards, S.E.I.C., has recently accepted a position with W. T. Brickenden & Associates, professional engineers, at Toronto, Ont.

Yves Décarie, S.E.I.C., formerly employed by Canadian Car & Foundry Limited at Longue Pointe, Que., is now in the Engineering Department of the City of Montreal.

Gérard Lefebvre, S.E.I.C., has been appointed superintendent of the Montreal extension of St. Jerome Branch of the Dominion Rubber Company Limited.

H. K. Morris, S.E.I.C., formerly a flight-lieutenant in the R.C.A.F., has returned to civilian life and is now employed by the Consolidated Paper Corporation Limited as an assistant in the Purchases and Stores Department at Montreal.

Fernand Labrosse, S.E.I.C., is at present employed by the Mathews Conveyer Co. Limited, at Port Hope, Ont.

Kenneth R. Knights, S.E.I.C., has enlisted in the R.C.E.M.E. and is at present training at Barriefield, Ont. He was formerly employed by Canadian Westinghouse Co. Limited in the capacity of home office service engineer in the Niagara district.

Lionel Boulet, S.E.I.C., is now employed by R.C.A. Victor in Montreal, Que. He graduated in electrical engineering at Laval University, Quebec, last spring.

Obituaries

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

Seymour Jost Fisher, M.E.I.C., died at his home in Riverbend, Que., on December 18th, 1944. He was born at Musquodoboit Harbor, Nova Scotia, on July 6th, 1880.

After high school he worked for seven years as a machinist with the Robb Engineering Company at Amherst, N.S., before entering Mount Allison University where he studied mechanical engineering for two years and was in charge of the mechanical engineering course for one year. He then spent two years at McGill University, graduating in 1910 with honours and the British Association Medal.

The next six years were spent as sales and service engineer with Babcock-Wilcox, then two years with the Imperial Munitions Board at Ottawa during the first World War as assistant to the officer in charge of gauges and standards. For one year he was assistant mechanical superintendent of the Caron Brothers plant at Montreal, after which he was with the James Smart plant at Brockville, Ont., for two years as general superintendent.

Mr. Fisher entered the paper business in 1922 and spent more than four years with the E. B. Eddy Company at Hull, Que., as works and woods manager. For the next five years he was employed by the Lake St. John Power and Paper Company, first working on mill design and erection and later as operating manager of the company's mill at Dolbeau. In 1931 he was appointed general superintendent of the Riverbend mill of Price Brothers & Company Limited which position he held at the time of his death.

Mr. Fisher joined the Institute as an Associate Member in 1915, transferring to Member in 1919.

Robert Selwyn Roche, M.E.I.C., died suddenly at his home in Montreal, Que., on January 11th, 1945. Born in Auckland, New Zealand, on October 24th, 1893, he received his engineering education in that country.

From 1914 to 1919 he served in the engineering services of the New Zealand Expeditionary Force after which he went to the United States where he was for one year assistant engineer on the New York Water Power Investigation. In 1921 he became identified with petroleum development and in 1927 went to Tulsa, Oklahoma, where for the next fifteen years he was engaged in consulting practice on petroleum production engineering, design and construction of oil storage, pipe lines, etc.

From 1942 Mr. Roche was connected with the department of works and buildings, Naval Service Headquarters at Ottawa, Ont., as petroleum engineer in charge of design for naval fuel oil installations, until a month before his death when he had moved to Montreal as development engineer with Mainguys Limited.

Mr. Roche joined the Institute as a Member in 1944.

News of the Branches

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

BORDER CITIES BRANCH

W. R. Stickney, m.e.i.c. - *Secretary-Treasurer*
G. W. Lusby, m.e.i.c. - *Branch News Editor*

The regular monthly meeting and annual election of officers of the Border Cities Branch was held at the Prince Edward Hotel on December 8th, 1944, with J. B. Dowler, chairman of the Branch, presiding.

The speaker of the evening was J. G. Hoba, assistant chief engineer, Kelsey Wheel Company Limited, who gave a short talk on **Magnesium Aircraft Wheels.** Mr. Hoba stated that magnesium made its first appearance as a metal in 1832 when Sir Humphry Davy produced it by electrolysis of the chloride but it was not manufactured commercially until 1900.

During the last war the allies set up several plants for the production of magnesium which was, at that time, used chiefly for the production of flare shells. After the war some of these plants were closed because no extensive use for the metal could be found for civilian purposes.

The main sources of magnesium are sea water and such minerals as brucite, dolomite and magnesite. Brucite, which is the richest ore in magnesium, is found in Canada and Nevada.

The production of the metal, which is comparatively recent in the United States and Canada, amounts to about 365 million pounds in U.S. and 6½ million pounds in Canada. The characteristic affinity of the metal for oxygen limits its production to the electric furnace and the electrolytic process, the more outstanding of these being the Hansgrig Carbothermic Process and the Dow-Seawater process, respectively. In Canada, a process developed by Dr. Lloyd M. Pidgeon of the National Research Council, is used extensively.

The importance of magnesium lies in its extreme lightness. It is because of this characteristic that the metal is being adopted for airplane parts to a great extent, and particularly to the manufacture of airplane wheels. By the use of magnesium the weight of a wheel can be reduced 50% and at the same time retain the strength it had when it was made of aluminum. Because of the lightness of the metal, all wall dimensions are increased for casting purposes but machining is comparatively simple.

In conjunction with the description of various airplane wheels, the speaker entered into a discussion of the various brake constructions used on airplane wheels, the main features under consideration in the design of such brakes being the proper dissipation of heat due to friction and the magnitude of the "sweep", the full 360 deg. sweep having at last been attained by the use of an expander tube.

HAMILTON BRANCH

W. E. Brown, m.e.i.c. - *Secretary-Treasurer*
L. C. Sentance, m.e.i.c. - *Branch News Editor*

On Thursday, December 14th, the regular monthly meeting of the Hamilton Branch was held in the Science Lecture Room, McMaster University. Twenty-five members and guests were in attendance. N. Eager, vice chairman, conducted the meeting.

H. G. Chambers introduced the speaker of the evening, F. J. McMulkin of the Ontario Research Foundation, whose subject was **The Welding and Fabrication of Canadian Light Armour.** Mr. McMulkin, in his capacity of metallurgist and welding engineer, has been intimately connected with the manufacture of light armoured vehicles in Canada.

During the course of his talk Mr. McMulkin discussed the fundamental requirements of armoured vehicle construction, and outlined the production procedures developed to meet these requirements in the case of welded types. Numerous slides were utilized during the presentation of the paper. Mr. McMulkin answered questions on the subject at the conclusion of his talk.

The meeting adjourned at 9.30 p.m. for the customary refreshments.

LAKEHEAD BRANCH

J. I. Carmichael, m.e.i.c. - *Secretary-Treasurer*
R. B. Chandler, m.e.i.c. - *Branch News Editor*

The December dinner meeting of the Lakehead Branch took the form of a joint session with the members of the Port Arthur Rehabilitation and Reconstruction Council in Port Arthur on December 15th, 1944.

S. T. McCavour, chairman of the Branch, welcomed the Honourable C. D. Howe, Minister of Munitions and Supply and Reconstruction, and the members of the local Reconstruction Council. He then turned the chair over to Alderman T. J. McAuliffe who spoke on the work of the Reconstruction Council of which he was chairman, and who called on Mr. Howe to address the meeting.

Mr. Howe gave a comprehensive review of the plans of his department for the immediate post-war period. He said that the first tasks were the conversion of industry to a peace-time footing, revival of Canadian export trade and the restoration of devastation of war. He advocated a "common sense" approach to reconstruction. The first duty should be an attempt to employ men and women in work similar to that in which they were employed. Consequently the government was making plans for reconversion of certain factories.

Outlining the form of his reconstruction department he said only a skeleton organization had been built but that branches were being added steadily. There was a deputy minister and several directors, including directors of development, research and housing.

A co-ordinator of public projects had also been appointed. One of his duties would be to list and place in sequence all public projects proposed by the Dominion, provincial and municipal governments. Regional committees would then be formed. There would be a co-ordinator of controls also as certain controls must be carried on to avoid inflation. Mr. Howe also referred to his earlier announcements about the appointment of a director of disposal of war assets and the establishment of a branch office of the department in Port Arthur.

Mr. Howe was thanked on behalf of the meeting by R. B. Chandler of the Lakehead Branch and M. J. McDonald of the Reconstruction Council.

Following Mr. Howe's address Mr. McCavour reoccupied the chair and introduced Mr. James Murchison, Fort William Town Planning Consultant and District Representative of the Ontario Department of

Town Planning. Mr. Murchison's address covered general town planning problems with specific mention of those relative to the Lakehead cities.

Mr. Murchison was thanked for his address by S. E. Flook.

LETHBRIDGE BRANCH

T. O. Neuman, m.e.i.c. - *Secretary-Treasurer*
A. G. Donaldson, m.e.i.c - *Branch News Editor*

A meeting of the Branch took place November 24th in the lecture rooms of the local Y.M.C.A. when D. L. Hamelin, water supply engineer for the Department of Transport delivered a very fine address entitled **Development of Underground Water in the Province of Alberta—a Post War Project.** The speaker gave many interesting facts and provided thoughts entirely new to many of those present.

On December 15th a meeting was held in the Marquis Hotel and consisted of a dinner meeting to which the ladies were invited. A. L. H. Somerville presided. The speaker of the evening was T. C. Main, general manager of Ducks Unlimited. His address was entitled **Ecological Engineering.**

Before starting on his paper Mr. Main made a few pointed remarks to engineers as a body stating that the engineer could contribute a great deal more to the progress of mankind if he would seek public office, or at least place his opinions before the public. He must become a leader rather than a follower.

Mr. Main opened his address by explaining that Ecological Engineering was "that branch of engineering devoted to wild life management." Ducks Unlimited was formed in 1938. It now numbers engineers, naturalists, ornothologists, etc. on its staff, all of whom are Canadians. Because drought is the greatest menace to the duck population, the chief work done by Mr. Main and his staff is to combat this. Many projects have been undertaken such as the building of dams, reservoirs, canals: the rerouting of streams and the further flooding of marsh lands. To date 135 of these projects have been completed with an equal number still to be undertaken. 1,200,000 acres of marsh lands and sloughs have been made safe nesting grounds; 200,000 acres of permanent surface water have been added to the prairie provinces. Incidental to the main object, fur trapping and cattle raising have been materially helped in areas near the projects. In the main object, handsome dividends have also been returned as proved by the increase in ducks from 35 millions in 1935 to 140 millions in 1944.

The address was illustrated by some excellent films,

LONDON BRANCH

A. L. Furanna, m.e.i.c. - *Secretary-Treasurer*
G. N. Scroggie, m.e.i.c. - *Branch News Editor*

The London Branch held their annual meeting and dinner Wednesday evening, January 17th, at the C.P.R. Hotel, at which the new executive for the year took office.

This year the branch held a mail-ballot electing eight men to the executive, who in turn elected a chairman, vice-chairman, and secretary-treasurer from among themselves.

The results of the election were as follows: Chairman —H. G. Stead; Vice-Chairman—G. A. Cunningham; Secretary-Treasurer—A. L. Furanna; Executive—F. A. Bell, J. H. Johnson, H. A. McKay, G. N. Scroggie, and H. J. Simmons.

E. V. Buchanan introduced the speaker, Dr. R. C. Dearle, head of the Department of Physics at the University of Western Ontario. Dr. Dearle told the story of his own department during the years of this present war, and described the work especially with regard to radio detection or radar. He told of the training of university men, many of whom now hold important posts in the Armed Forces. He also told of the securing of financial backing for the training of technicians, the financial backing being given by the London Association for War Research.

Before closing, Dr. Dearle mentioned the tremendously important part radar played in the Battle of Britain, and told of some of its present uses by the Navy and Air Force, and of its possible future use in civil aviation.

Needless to say, the speaker did not divulge any military secrets, but there was so much he would like to have said and so much his very interested listeners would have liked to have asked him, that J. R. Bach, in thanking the speaker, expressed the hope that some day he would come back and speak to the Branch when he could give the inside story of radar.

Following the address, R. S. Charles, the retiring chairman, spoke briefly before turning the meeting over to the newly elected vice-chairman, G. A. Cunningham, who welcomed the new members of the Branch and urged them to attend all future meetings.

MONTREAL BRANCH

L. A. Duchastel, m.e.i.c. - *Secretary-Treasurer*
H. H. Schwartz, m.e.i.c. - *Branch News Editor*

On Thursday evening, January 11th, 1945, Dr. P. M. Haenni, Director of Research for the Aluminium Laboratories, presented a paper on **The Future of Aluminum** to the Montreal Branch. Dr. Haenni stated that the future for the aluminum industry looked very promising and outlined the steady rise in the demand for aluminum and aluminum alloy products since the beginning of this century. He pointed out that the qualities and physical properties were steadily improving, culminating in the new 75S alloy. On the other hand the price has, except for the World War I years, continually fallen until it is now at its lowest in history. In the past five years, many new techniques, such as continuous casting and extrusion, have been successfully applied in the processing and fabrication of these alloys.

The speaker stated that in the immediate post war period there would be a great demand for consumer goods, made entirely or largely of aluminum, and it is expected that the quantities of scrap now on hand will only partially fill these requirements. Because of the great technological advances and the drop in price, it is expected that these alloys will find increasing application in architecture, structures, transportation equipment and industrial machinery.

Dr. Haenni illustrated his lecture with graphs, tables and photographs of aluminum products. After a lively discussion R. N. Coke thanked the speaker. R. A. A. Hayes was the chairman of the evening.

* * *

On Thursday evening, January 18th, 175 persons of the E.I.C. and A.I.E.E. Montreal branches met at a joint meeting at E.I.C. headquarters, where they enjoyed a talk on the amplidyne machine.

J. L. McKeever, general engineer of Canadian General Electric Co., Peterborough Works, who is in a position to know about most recent developments in this field, was the speaker. He mentioned the use of the amplidyne machine for operation of aircraft gun-turrets. Among its industrial applications is the control of a flying shear for a hot-strip mill.

In conclusion, the speaker acknowledged the source of material for this paper as being the published work of many engineers of the General Electric Company.

Chairman of the meeting was F. L. Lawton.

PETERBOROUGH BRANCH

Eric Whiteley, Jr.E.I.C. - *Secretary-Treasurer*
F. Osborn, Jr.E.I.C. - - *Branch News Editor*

This year marks the Twenty-Fifth Anniversary of the Peterborough Branch and the event was celebrated on Wednesday, December 6th, with a dinner at the Kawartha Club.

C. R. Whittemore, branch chairman, welcomed the guests of the evening including, in addition to the president and general secretary: Mayor James Hamilton, Rev. J. Sutcliffe, Past-President J. M. R. Fairbairn of Montreal, H. Morrow, C. E. Sisson of Toronto and Hugh Rose. Ross Dobbin was then asked to give a short history of the Branch. He recalled some of the better known figures who had been in the local organization and recounted a few of the outstanding activities, such as out of town inspection trips. In 1919 engineers of the city, who had previously organized an engineers' club, received a charter from The Engineering Institute of Canada and since that time the Institute has been the only active technical organization in the city.

Mayor Hamilton said a few words to the visitors on behalf of the City of Peterborough, at the same time taking the opportunity to commend the members on the contribution engineers are making to community life. A welcome from the Branch was voiced by Maurice St. Jacques, a native of Mr. Beaubien's home province. The president was introduced by G. R. Langley who, by way of diversion, revealed that a young lady of Peterborough returning to her native heath with her navy husband and two children, while travelling from Montreal on the same train had been assisted in her family cares by the presidential party and had found them "kindly old grandfathers."

The president, Mr. de Gaspé Beaubien, spoke gratefully of the honour bestowed upon one chosen for this office. He had just completed a tour of the branches and universities and was particularly moved by the unity of outlook displayed by engineers the country over. He intimated that if there were a few elements of disunity in the nation, there was certainly unity of thought and purpose amongst engineers. Mr. Beaubien pointed out that we should not be too concerned by impressions of friction gained from the newspapers which, after all, are tempted to print astonishing things to attract the readers. The ordinary things and the people who do not put on demonstrations are frequently overlooked. He had found that there were many things that all Canadians had in common. The president is himself a gracious person who has no small influence on better relations between those of his own racial extraction and Canadians of other background. The listeners were warned against the slackening of efficiency due to war weariness or over optimism, and it was asserted that our energy must be carried over to the post-war world.

Dr. L. Austin Wright, general secretary, reported briefly on measures taken during the year to cope with unusual conditions. In particular, a permanent official is being considered to work on problems of veteran reestablishment and an active part has been taken in negotiations relating to collective bargaining. Dr. Wright was full of hope for a continuing increase in membership and an improved service to the members and the profession.

Prior to the dinner, Mr. Beaubien met the membership informally and inspected a display of old photographs of persons and events which had a place in the branch history. About 65 persons sat down to the meal which was enlivened by short interludes of group singing led by N. Finnie who accompanied on the guitar.

SASKATCHEWAN BRANCH

Stewart Young, M.E.I.C. - *Secretary-Treasurer*

The Saskatchewan Branch met jointly with the Association of Professional Engineers in the Kitchener Hotel, Regina, on Monday evening, December 18th. The attendance was 42. J. McD. Patton occupied the chair.

Hon. J. H. Brockelbank, Minister of Municipal Affairs, addressed the meeting on **Municipal Affairs,** dealing in particular with the proposed re-organization of Saskatchewan Rural Municipalities.

Outlining the work of his department Mr. Brockelbank emphasized the importance of local government, which, he said, was the foundation of democracy and should be preserved and strengthened in every way possible.

The re-organization of municipalities into larger units of administration was not a trend towards centralization as suggested in some quarters "but the exact opposite," stated the minister. He pointed out that any government that wanted greater centralization would take steps to weaken local self-government. The re-organization of the municipalities was designed to strengthen local self-government.

Mr. Brockelbank said he had received requests from six muncipalities to appoint councillors because the electors had failed to nominate or elect a councillor to fill vacancies that would exist on the local councils after January 1st. The minister preferred not to make such appointments declaring that such vacancies should be filled by elections as provided for under legislation.

TORONTO BRANCH

S. H. de Jong, M.E.I.C. - - *Secretary-Treasurer*
G. L. White, Affil.E.I.C. - *Branch News Editor*

"Without nitrogen war is impossible," so stated Stanley R. Frost, who was, previous to the war, sales director for North American Cyanamid Company, and at present is special assistant to the Controller of Chemicals, Department of Munitions and Supply, in an address before the Toronto Branch on December 7th. Mr. Frost noted that nitrogen is the basic element of all explosives and pointed out that Germany did not enter into the first World War until the development of the Haber process had made her virtually independent of outside nitrogen sources. Similarly before the present conflict, her nitrogen producing capacity had been greatly expanded.

Canada's nitrogen industry can be said to have started in 1908 through a small plant located at Niagara Falls engaged in producing cyanamid. By 1930 this plant was the largest in the world and was turning out cyanamid at the rate of 300,000 tons per year. The process of taking nitrogen out of the air and forming it into chemical compounds is usually called "nitrogen fixation" and at the cyanamid plant is performed as follows. Lime and coke are heated in an electric furnace

PETERBOROUGH BRANCH CELEBRATES TWENTY-FIFTH ANNIVERSARY

(*Left*) From far end of table to near: H. A. Morrow, J. M. R. Fairbairn, G. R. Langley, de Gaspé Beaubien, C. R. Whittemore, L. A. Wright, Ross Dobbin, Mayor J. Hamilton.

(*Right*) View of tables: N. Finnie with guitar.

(*Left*) *Left to right:* G. R. Langley, de Gaspé Beaubien, H. R. Sills, C. R. Whittemore, L. A. Wright.

(*Above*) Back row, *left to right:* R. Dobbin, C. E. Sisson, G. R. Langley, B. L. Barns, Al. Dickieson, J. Barnes. Seated, *left to right*: W. M. Crothers, Hugh Rose, H. A. Morrow, Mayor Hamilton, T. E. Gilchrist. (Present first dinner 25 years ago.

(*Left*) *Left to right*: S. O. Shields, Ham, B. I. Burgess.

at a temperature of practically 4,000 deg. F., when calcium of the lime and carbon of the coke combine to give calcium carbide. This material when it is ground to a fine state actually burns in an atmosphere of nitrogen to give the calcium cyanamid $CaCn_2$. The nitrogen for this reaction is obtained by fractional liquefaction of air.

In 1941 when it appeared that England's synthetic nitrogen plants might be destroyed or impaired by bombing, allied high authorities agreed on the desirability of establishing in Canada adequate nitrogen capacity to be available during an emergency. Consequently there was built in Canada at Trail, B.C., Calgary, Alta., Welland, Ont., and at other places, plants which doubled Canada's previous synthetic nitrogen capacity and made it almost equal to that of the United States before that country entered the war. However, England's plants were not seriously affected and an apparent Allied surplus of nitrogen resulted. Investigations were immediately instigated to find increased uses for this unexpectedly available material.

In addition to explosives, one other large-scale use for nitrogen compounds is in agricultural fertilizers. In this respect ammonium nitrate is particularly desirable since nitrogen content is 35 per cent. Hence, in order to utilize the surplus nitrogen capacity in Canada, an intensive check was made for ways of employing ammonium nitrate as a fertilizer. Ammonium nitrate as a fertilizer material suffers from its peculiar property of absorbing moisture from the air and setting into a hard lump which is difficult to handle and, due to its low solubility, is not readily utilized by the plant.

These difficulties were finally overcome by Canadian scientists working in collaboration with the Canadian and United States Governments who developed the nitraprill process which consists of coating fine mesh ammonium nitrate with a thin layer of filter aid or other suitable dusting agent, thus rendering it free flowing. The available nitrogen is 32.5 per cent.

With Canadian nitrogen capacity far in excess of consumer demand for a number of years, the industry must look to exports for markets. As produced, however, the Canadian price is low, and Canada is in a reasonable position to face the future with some degree of confidence if advantage is taken of her favourable factors of erected plant, trained personnel and cheap raw materials.

* * *

Wartime Transport of Food was the subject of the address by Dr. W. H. Cook, Director, Division of Applied Biology, National Research Council, Ottawa, before a meeting of the Toronto Branch on Thursday, January 18th, 1945.

In his address the speaker dealt particularly with refrigerated space for the shipping of meats and other perishable products to Great Britain. Under normal conditions standard refrigerated space in cargo vessels provides for transport of meats to Great Britain. A critical situation arose in 1941 due to sinkings and to slower operation of vessels in convoy. In this emergency very successful refrigeration space was improvised for transport of bacon to Great Britain. Requirements of this refrigerated space was the ability to maintain the bacon at temperatures somewhere in the vicinity of 35-40 deg. F. during transport.

In order to accomplish this improvisation of refrigerated space, special compact refrigeration units weighing three tons, were devised, which provided about five tons of refrigeration capacity. These units were installed in such a way as to provide circulation of cold air around the outside of the bacon cargoes in the refrigerated hold. Special provision was made for rapid installation with little change in the ship. Results were excellent with the first cargo arriving in Great Britain with quality equal to bacon shipped in regular refrigerated space. The cargo air temperature in the hold was maintained at an average of approximately 40 deg. F.

The speaker described briefly subsequent experience which involved the application of the emergency refrigeration unit to holds in all positions in cargo vessels and the development of more efficient defrosting technique to increase the overall efficiency of the refrigeration unit.

Discussing Army feeding, Dr. Cook referred to the highly developed rations designed for individual cooking which provide operational food on which men may live for many days under the difficult feeding conditions of modern warfare. Dehydration has helped a great deal especially in reducing tinplate consumption, and also conserving shipping space.

Food problems in the Pacific theatre of war have been reduced considerably by the employment of obsolete vessels as refrigerator ships in that area.

Junior Section

The Junior Section held a dinner meeting in Diana Sweets restaurant on Monday, January 8th at 6.30 p.m. with Ross Graydon as chairman.

The topic of the meeting, **Steps that are being taken to Consolidate and Elevate the Engineering Profession in Canada,** was discussed first by Major M. Barry Watson who spoke on the co-ordination activities of the Dominion Council of Professional Engineers of Canada.

Major Watson cited the progress that had been made in obtaining co-operative agreements between the Professional Associations and the E.I.C., four of the eight having voted for co-operative agreements—with two more provinces likely to form agreements in the near future. The small committee of the Dominion Council (one member from each association) is quite flexible, and since the members' travelling expenses are paid by the associations, the meetings can be said to be very representative and no one province is able to outvote the others.

Dean C. R. Young spoke on the Engineers' Council for Professional Development, of which the E.I.C. is a member. Dean Young stated that this body was studying problems such as student selection and guidance, professional training, professional recognition and engineering ethics. One concrete example of the work of this committee was the accrediting of engineering schools and courses.

In the business portion of the meeting, the action of the Council of the E.I.C. was criticized for deciding to employ an additional staff member to look after the rehabilitation of its members. It was felt that this was a duplication of effort—and should be left to the Wartime Bureau of Technical Personnel, which the E.I.C. helped to set up.

WINNIPEG BRANCH

T. E. Storey, M.E.I.C. - - *Secretary-Treasurer*
V. W. Dick, M.E.I.C. - - *Branch News Editor*

On Thursday, January 11, 1945, a joint general meeting of the Winnipeg Branch of the Institute and the Manitoba Association of Professional Engineers was held in theatre "F" of the University of Manitoba, under the chairmanship of T. H. Kirby, branch chairman.

R. A. Sara, chairman of the committee in charge of publicity for the 59th Annual and Professional Meeting of the Institute to be held in Winnipeg on February 7th and 8th of this year, outlined the programme for this meeting. Mr. Sara made an appeal to the engineers of Manitoba to register in advance in order to leave the opening day free for the registration of the visiting engineers, who were expected from all parts of Canada and from the U.S.A. D. M. Stephens presented the report of the nominating committee of the Winnipeg Branch, giving a complete slate of officers and the executive committee for 1945, which was accepted without any further nominations.

The address for the evening was then presented by Dr. P. A. Macdonald, physicist with the Manitoba Cancer Institute, who spoke on the design and construction of high-voltage X-ray tubes, as used by the Cancer Institute. These machines represent a considerable advance over the conventional type of tube with its high-vacuum and tremendous weight of lead protection from the rays, which are necessary for the protection of the operators.

A new system of forming the filament type of emitter was described, which enabled a heavier filament to be constructed for use at a lower vacuum, and a lower temperature range.

Various types of targets were detailed, and a new type of target designed at the Institute was described, which utilizes an extremely thin film of gold electroplated on a copper disc. Different ways of cooling the target were given, along with new methods that the Institute was working on, that would utilize the latent heat of evaporation to give greater cooling efficiency.

Dr. Macdonald pointed out that these machines were of great interest to engineers, as similar machines are used in the radiography of metals. A great deal of testing has been eliminated through X-ray examination of iron castings and welded metal. The denser the metal, the higher the voltage required, and machines using 2,000,000 volts are now at work in war industries.

Dr. Macdonald forecast a revolutionary method of producing X-rays, now in the laboratory stage, using low-voltage equipment with a circular method of controlling and increasing the speed of the electrons, to produce more rays with lower voltages and therefore much greater efficiencies.

The speaker had an interesting display of the parts of the machine described during his address, and after a discussion period the members present had the opportunity to examine these parts at close range. A vote of thanks was moved by Prof. N. M. Hall.

Library Notes

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

TECHNICAL BOOKS

How You Can Get a Better Job:
Willard K. Lasher and Edward A. Richards. Chic., American Technical Society, 1945. 5¾ x 8½ in.

Metallurgical Analysis by Means of the Spekker Photo—Electric Absorptiometer:
F. W. Haywood and A. A. R. Wood. Lond., Adam Hilger, 1944. 6¾ x 9 in. 18s.

Sheet Metal Theory and Practice:
John C. Butler, N.Y., John Wiley and Sons, 1944. 8½ x 11½ in. $3.00.

What is Vocational Education?
George H. Fern. Chic., American Technical Society, 1944. 5¾ x 6½ in.

Wireless Receiving Devices:
P. J. Risdon. Lond., Foulsham and Co. (n.d.) 3¾ x 5¾ in. 1s.

PROCEEDINGS, TRANSACTIONS, ETC.

Engineering Society of Buffalo, Inc.:
Yearbook, 1944.

REPORTS

Canada—Department of Mines and Resources:
Hydro-Electric Progress in Canada during 1944.

Canada—Bureau of Northwest Territories and Yukon Affairs:
Northwest Territories; administration, resources, development, 1944.

Ohio State University—Engineering Experimental Station—Bulletin:
No. 120; Weather headings in Ohio, by George W. Mindling.

Ontario—Department of Mines:
Review of Geophysical work carried out by the Ontario Department of Mines, 1937–1944, by A. A. Brant.

United States—Bureau of Mines—Bulletins:
No. 462; Coal-mine Accidents in the United States, 1942, by L. E. Geyer. No. 460; Diatomites of the Pacific Northwest as Filter-aids by K. G. Skinner and others.

United States—Bureau of Mines—Technical Paper:
No. 668; Low-temperature Carbonization of Alaskan Coals, by W. A. Selvig and others.

United States—War Mobilization and Reconversion:
First report to the President, the Senate, and the House of Representatives, 1945.

MONOGRAPHS AND PAMPHLETS, ETC.

Air Power:
Aeronautical Chamber of Commerce of America. 1944.

Air Power Can be Peace Power:
G. W. Vaughan. Air Industries and Transport Association of Canada, 1944.

Brief for Shipbuilding with Recommendations:
By Canadian Shipbuilding and Ship Repairing Association, 1944.

Economics of a Free Society; Declaration of American Business Policy:
Reprinted from Fortune, October, 1944.

Essentials of Metrology:
C. H. Klawe. Toronto, Progress and Engineering Corporation, Ltd., 1944.
T. D. Bulletin, No. 2.

John Bracken Says:
John Bracken. Toronto, Oxford University Press, 1944.

International Business Conference, Rye, N.Y., November 10 to 18, 1944:
Report. Reprinted from Industrial Canada, December, 1944.

Limits and Fits:
C. H. Klawe. Toronto, Progress and Engineering Corp., Ltd., 1944. T. D. Bulletin, No. 3.

Manual of Industrial Radiography with Radium:
Canadian Radium and Uranium Corporation, 1942.

Place of Canada in Post-War Organization:

Brooke Claxton. Reprinted from Canadian Journal of Economics and Political Science, v. 10, no. 4, November, 1944.

This Housing Problem:

W. H. Bosley and H. E. Manning. Toronto, Bosley and Co., 1944.

Wartime Controls:

Canada—Wartime Information Board, 1944.

Wartime Industrial Transit Plan:

Canada—Department of Munition and Supply—Transit Control, 1944.

BOOK NOTES

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.

ALLOY CAST IRONS

Reviewed, revised and published by the Alloy Cast Irons Committee, Gray Iron Division, American Foundrymen's Association, 222 West Adams St., Chicago 6, Illinois, 1944. 282 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $3.25.

The effects of alloys on cast iron, the alloys available for foundry use, the effect on physical properties, methods of adding them, the heat treatment of alloy cast irons, foundry practice and specific uses are discussed in this volume. The various chapters have useful bibliographies.

ANYTHING A HORSE CAN DO, the Story of the Helicopter

By H. F. Gregory, introduction by I. Sikorsky. Reynal & Hitchcock, New York, 1944. 243 pp., illus., diagrs., 8¼ x 5½ in., cloth, $3.00.

In any easy, informal way this book tells the story of helicopter development. The author traces its history, explains its principles and discusses its future. As an expert for the U.S. Army, the author has played a large part in the development of this plane and much of his story is the record of personel experience.

BATTERY-ELECTRIC VEHICLES

By S. M. Hills. George Newnes, Ltd., Tower House, Southampton St., Strand, London, W.C.2, England, 1943. 206 pp., illus., diagrs., charts, tables, 9 x 6¼ in., cloth, 12s. 6d.

This book deals with all types of battery-operated electric vehicles and their accessories including light and heavy trucks, tractors, locomotives, buses, passenger cars, etc., Batteries, charging equipment and care and maintenance are discussed as well. The possible fields of use are pointed out, and British practice is thoroughly reviewed. There is a bibliography, but confined to British publications. This is the first book on the subject in twenty-five years.

BROACHES AND BROACHING, First Edition.

Broaching Tool Institute, 74 Trinity Place, New York, 1944. 97 pp., illus., tables, 11 x 8 in., fabrikoid, $3.00.

A brief historical sketch precedes a discussion of the advantages, applications and limitations of broaching. The later chapters give technical information on the types of broaches, design procedure, and current broaching practice. The subject of costs is briefly treated.

CABLE CAR DAYS IN SAN FRANCISCO

By E. M. Kahn. Stanford University Press, Stanford University, California, 1944. 134 pp., illus., tables, 10¼ x 7 in., cloth, $3.00.

This informal narrative covers the history of the cable car railroads in San Francisco from their beginning to the present day. The background of contemporary life in San Francisco is brought out by anecdote and description and is highlighted by the activities of the notable characters connected with the various enterprises. A large number of contemporary photographs illustrate the text.

DIVING, CUTTING AND WELDING IN UNDERWATER SALVAGE OPERATIONS

By F. E. Thompson, Jr. Cornell Maritime Press, New York, 1944. 214 pp., illus., diagrs., tables, 7½ x 5 in., cloth, $2.00.

This book is intended both as a text for men who are learning the work and as a practical manual for all those who are actively engaged in such operations. The material covers diving theory and practice under varying conditions, describes and demonstrates the use of all types of cutting and welding equipment for underwater work, and includes a section of useful data and definitions.

EXPERIMENTAL STRESS ANALYSIS (Proceedings of the Society for Experimental Stress Analysis, Vol. 2, Number 1, held at the Hotel Statler, Boston, Mass., May 18, 19, 20, 1944)

Published and distributed by Addison-Wesley Press, Kendall Square Bldg., Cambridge 42, Mass. 225 pp., illus., diagrs., charts, tables, 11¼ x 8½ in., cloth, $5.00.

This volume contains the papers presented at the 1944 spring meeting of the Society and symposium on residual stresses. Twenty-one papers are included, which discuss methods of measuring residual stresses and related topics.

HENLEY'S TWENTIETH CENTURY BOOK OF FORMULAS, PROCESSES AND TRADE SECRETS

Edited by G. D. Hiscox, 1944; revised and enlarged edition by T. O. Sloane. Norman W. Henley Publishing Co., 17-19 West 45th St., New York, 1944. 865 pp., diagrs., tables, 8½ x 5½ in., cloth, $4.00.

This well-known collection of recipes, formulas and processes has again been revised. New formulas have been added and new sections included on plastics and on photography. Old formulas have been replaced by better ones.

INDUSTRIAL SUPERVISOR, a Training Guide for Improvement of Skill and Leadership

By J. M. Amise and T. C. Sutton. Ronald Press Co., New York, 1944. 243 pp., diagrs., tables, 8¼ x 5¼ in., cloth, $3.00.

The beginning chapters discuss general supervisory responsibilities and the general qualifications of a supervisor. Succeeding chapters deal with the many specific responsibilities of the supervisor from a practical viewpoint, provide necessary technical information, and show how particular qualifications may be gained or improved. The book is intended for home study, industrial training departments or conference discussions by small groups.

MECHANICAL INSTALLATIONS (Post-War Building Studies No. 9)

Compiled by the Institution of Mechanical Engineers and published by His Majesty's Stationery Office, London, 1944. 119 pp., diagrs., tables, 9½ x 6 in., paper, 2s. (Obtainable from British Library of Information, 30 Rockefeller Plaza, New York ($0.60).

The object of this series of British reports is to secure a comprehensive and coordinated review of building technique for the guidance of those who will be responsible for the direction and organization of building after the war. This present report on mechanical installations covers the following: lifts, hoists and escalators; cooking installations (except for homes); heating, ventilating and air-conditioning; wells, bore-holes and fire-fighting appliances; building power plants; and refrigerator equipment in buildings.

METALLOGRAPHY AND HEAT-TREATMENT OF STEEL Ferrous Metallurgy, Vol. 3. (Mineral Industries Series).

By E. J. Teichert. 2 ed. McGraw-Hill Book Co., New York and London, 1944. 577 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $5.00.

The text on ferrous metallurgy, of which this is the final volume, is intended especially for those employed in the steel industry who wish to acquire a working knowledge of fundamental principles. In this volume the physical metallurgy of the iron and steel alloys, metallography and heat treatment are considered. The work is well adapted for private study.

MITTEILUNGEN AUS DEM INSTITUT FÜR BAUSTATIK AN DER EIDG. (Technischen Hochschule in Zürich, Mitteilung Nr. 14. Preisausschreiben der Culmann-Stiftung 1941/1942, Zusammenfassung der Preisarbeiten in Statik Massiveau Stalbau)

By E. Derron and others. A. G. Gebr. Leemann & Co., Zürich and Leipzig, 1944. 73 pp., diagrs., charts, tables, 9 x 6 in., paper.

In 1941 the Culmann Foundation offered prizes for the best papers on: 1. An analysis of the combined action of arch and superstructure in reinforced concrete bridges; 2. The influence of the percentage ratio of reinforcement of slabs and T-beams on the cost of reinforced concrete; 3. The establishment of the economic limit of the span of lattice girders and compound girders. The eight papers that received prizes are published in this pamphlet.

STEAMBOATS COME TRUE, American Inventors in Action.

By J. T. Flexner. Viking Press, New York, 1944. 406 pp., illus., diagrs., 8½ x 5½ in., cloth, $3.50.

Correction—Published in Canada by the Macmillan Company of Canada, Toronto, $4.50. For book note see January issue of the *Journal*. *(Continued on page 134)*

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

January 29, 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 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 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

ARCHIBALD—JOHN ALEXANDER, Elect. Sub-Lieut., R.C.N.V.R., of Peterborough, Ont. Born at Peterborough, Ont., April 18th, 1915. Educ.: 1944, graduate of special electrical course at 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); 1936-39, ap'ticeship., and 1939-40, asst. foreman, Can. Genl. Electric Co.; 1940-44, elect. artificer, and at present, Elect. Sub-Lieut., R.C.N.V.R.

References: F. H. Sexton, G. H. Burchill, J. Deane, J. J. Smith, G. R. Langley.

BERGER—STEPHEN ETIENNE, of Toronto, Ont. Born at Pécs, Hungary, March 13th, 1900. Educ.: Civil Engr., Univ. of Berlin, 1923; 1924, asst. engr., i/c elevator tower constrn., Pécs, Hungary; 1925-27, design of steel, reinforced concrete and timber structures, Kuhn und Schaim, Berlin; 1927-31, chief engr., structl. design section, Leiser B.M.b.H., Berlin; 1931-35, consltg. engr.; 1935-40, chief engr. and efficiency expert, design, calculation and supervision of foundations and superstructures of industrial bldgs., etc., La Générale Société Anonyme, Brussels; April, 1944, to date, designing engr., Hydro-Electric Power Commn. of Ontario, Toronto, Ont.

References: O. Holden, J. R. Montague, S. W. B. Black, G. R. Lord, E. B. Hubbard, S. H. deJong, W. E. Sheets.

BERTHIAUME—PAUL, of Arvida, Que. Born at St. Hyacinthe, Que., Feb. 19th, 1905. Educ.: Surveying, I.C.S.; 1925-27, dftsman., 1927-31, dftsman. and instr'mn., and 1936-40, designer, woodlands engrg. dept., Price Bros. & Co. Ltd.; 1940-41, instr'mn. and quantity engr., Foundation Co. of Canada, Ltd.; 1941-43, concrete engr. and sub-contractors' supt., and 1943 to date, chief time study engr., Aluminum Co. of Canada, Ltd., Arvida, Que. (Asks for admission as Affiliate.)

References: P. E. Radley, M. G. Saunders, F. T. Boutilier, D. D. Reeve, B. E. Bauman.

BROCKHOUSE—BERTRAM NEVILLE, Elect. Sub-Lieut., R.C.N.V.R., of Vancouver, B.C. Born at Lethbridge, Alta., July 15th, 1918. Educ.: 1944, graduate of special electrical course at N.S. Tech. Coll., given to selected personnel in the Navy qualifying them for commissioned officer. (Course approved by Council as meeting educational requirements for Junior); 1936-37, lab. asst., electronics lab., Aubert Controls Corp., Chicago; 1938-39, radio serviceman in own shop; 1941-44, elect. artificer and at present, Elect. Sub-Lieut., R.C.N.V.R.

References: F. H. Sexton, G. H. Burchill, J. J. Smith, J. Deane.

CROFT—PHILIP JAMES, of 1680 Athlone Road, Montreal, Que. Born at Weybridge, England, Nov. 24th, 1901. Educ.: 1918-20, London Polytechnic Inst. (evening classes), M., A.I.E.E.; 1918-20, ap'ticed to J. A. Maina, consltg. engr., London, Eng., 1920-27, dftsmn., estimator and junior engr., on power-station, sub-station, industrial plant layout, etc.; 1927 to date, asst. elec. engr. and elec. engr., in responsible charge of elec. design of many large undertakings, including Kirkland Lake frequency charger station and interconnecting sub., Back River Power House, Upper-Notch Automatic Station, etc., Power Corpn. of Canada, Ltd., Montreal.

References: H. L. Mahaffey, P. S. Gregory, J. S. H. Wurtele, G. L. Wiggs, D. Anderson, J. M. Crawford, G. Kearney, R. N. Coke.

DYCK—JACOB EDWARD, of Arvida, Que. Born at Herbert, Sask., Feb. 8th, 1908. Educ.: B.Sc. (Mech.), Univ. of Sask., 1930; 1928, instr'mn., and 1929, asst. chief., geol. survey., Dept. of Mines; 1930-31, instructor in mech. engrg., Univ. of Sask.; 1931 (summer), asst. to refrigeration research engr., Dept. of Fisheries, Prince Rupert, B.C.; 1931-32, instructor in mech. engrg., Univ. of Sask.; 1934-37, principal, high school, Harris, Sask.; with the International Nickel Co. as follows: 1937-39, dftsman., reinforced concrete and steel constrn., Copper Cliff, Ont., and 1939-41, mine survey and dfting. (Frood Mine); 1941-44, senior dftsman. and designer, reinforced concrete, heating, ventilation, etc., genl. engrg. dept., Montreal, and 1944 to date, statistician, industrial engrg. dept., Aluminum Co. of Canada, Ltd., Arvida, Que.

References: P. E. Radley, D. D. Reeve, B. E. Bauman, F. T. Boutilier, S. R. Banks.

FORD—ERNEST ARTHUR, of 720 Sherburn St., Winnipeg, Man. Born at London, England, Sept. 10th, 1903. Educ B.Sc. (Civil), Univ. of Man., 1927; 1927-28, structl. dfting., 1928-29, concrete detailing and designing, and 1929-30, prodn. engr., Dom. Bridge Co., Winnipeg; 1930-34, chief, shop inspn. dept., 1934-36, mining representative, and 1936-37, engrg. sales, including structl. and concrete design, and 1942 to date, asst. contract engr., Dominion Bridge Co. Ltd., Winnipeg, Man.

References: H. M. White, A. Campbell, F. S. Adamson, W. Walkden, A. W. Fosness, C. V. Antenbring.

GYGER—WILLY, of 1637 St. Luke St., Montreal. Born at Moscow, Russia, Dec. 8th, 1898 (Swiss parents, Naturalized Canadian); Educ.: 2nd and 3rd semester, Tech. Coll., Winterthur, Switzerland; 1924-27, Nouvelle Société de Construction, France; 1927-36, structl. and reinforced concrete dfting. on bridges, pumping station, reservoir, etc., Montreal Water Board; 1937 to date, reinforced concrete designer, tech. divn., Public Works, City of Montreal.

References: deGaspé Beaubien, H. A. Gibeau, C. J. Desbaillets, G. E. Templeman, J. F. Brett, F. Y. Dorrance.

HENDERSON—IAN BALFOUR, of Winnipeg, Man. Born at Brandon, Man., Oct. 23rd, 1921. Educ.: B.Sc. (Civil), Univ. of Man., 1944; 1938-40 (summers), chainman, 1941-42, rodman, and 1943 (summer), rodman, dfting. and test work, and at present, dftsman. working as engr. i/c mtce. field party, Port Arthur divn., Canadian National Rlys.

References: R. W. Ross, W. F. Riddell, A. E. Macdonald, E. P. Fetherstonhaugh.

JEFFERIES—JACK GLENN, of Arvida, Que. Born at Toronto, Ont., July 22nd, 1922. Educ.: B.Eng. (Met.), McGill Univ., 1944; 1939-43 (summers), Guysborough Mines, Ltd., C. C. Lindsay, Q.L.S., Montreal, Noranda Mines, Can. Car & Foundry Co., armaments divn.; 1944 to date, engr., Aluminum Co. of Canada, Arvida, Que.

References: M. G. Saunders, B. E. Bauman, F. T. Boutilier, D. D. Reeve, P. M. deChazal.

JELLY—KEITH BRADEN, of Arvida, Que. Born at Summerside, P.E.I., April 28th, 1917. Educ.: B.Sc., Acadia Univ., 1939; 1938-39 (summers), instru'mn., Dept. of Highways, P.E.I.; 1940-42, dftsman., 1942-43, asst. res. engr., and 1943 to date, cost engr. and asst. to supt., time study and efficiency dept., Aluminum Co. of Canada, Ltd., Arvida, Que.

References: P. E. Radley, B. E. Bauman, M. G. Saunders, A. C. Johnston, G. V. Reinhardt.

JONES—ROBERT JOHN, Lieut. (E), R.C.N.V.R., of Ottawa, Ont. Born at Montreal, Que., July 31st, 1918. Educ.: B.Eng., McGill Univ., 1941; 1938-39-40 (summers), McIntyre Porcupine Gold Mines, Frood Nickel Mines, Dome Mines; with the Royal Cdn. Navy as follows: 1941-42, in training and i/c watch, 1943-44, i c machy., minesweeper and escort vessel, 1944 to date, on staff of director of ship repairs, Naval Service Headquarters, Ottawa, Ont.

References: J. J. O'Neill, E. Brown, R. DeL. French, R. E. Jamieson, A. C. M. Davy, F. M. Wood, G. L. Stephens.

KEAY—JOHN ALEXANDER DISHINGTON, of Vancouver, B.C. Born at London, England, Aug. 11th, 1901. Educ.: R.P.E., B.C. (By exam.); 1920-32, dfting., quantity surveying, estimating, assisting in design of bldgs., etc., Hodgson, King & Marble, engrs. and contractors; 1937-38, engr. on constrn. of Lion's Gate Bridge, Stuart Cameron & Co. Ltd., Vancouver; 1938, structl. design for reinforced concrete pedestrian subway, 1939, design of wooden industrial bldgs., Arthur Pearson, M.E.I.C.; consltg. engr.; 1939-40, genl. supt., Pacific Engrs., Ltd., Vancouver; 1940-41, assisted in design of bldgs. for pulp mill, Arthur Pearson; 1941-42, engr., and 1942 to date, genl. supt., Northern Construction Co. & J. W. Stewart Ltd., Vancouver, B.C.

References: W. O. Marble, Arthur Pearson, William Smaill, N. D. Lambert, P. B. Stroyan.

KRAFT—FERDINAND, of Temiskaming, Que. Born at Darmstadt, Germany, Aug. 1st, 1899. Educ.: "Diplom-Ingenieur" 1923, "Doctor-Ingenieur" 1925, Tech. Univ., Darmstadt; 1923-24, asst. to prof. of organic chemistry, and 1925-26, instructor in cellulose chemistry, Tech. Univ., Darmstadt; with the Canadian International Paper Co. as follows: 1926-27, asst. research chemist, experimental rayon dept., Hawkesbury, Ont., 1927-35, chemist i/c research, 1936-44, asst. to tech. director, and i/c research and development, and 1945 to date, asst. to mgr. of sulphite mills, Temiskaming, Que.

References: H. R. M. Acheson, J. A. Freeland, H. D. Hyman, J. G. MacLaurin.

MILLER—JOHN JOSEPH, of 846 Seventh St., Arvida, Que. Born at Hamilton, Ont., Dec. 16th, 1917. Educ.: B.A.Sc., Univ. of Toronto, 1939; 1936-39 (summers), Steel Co. of Canada, Hamilton; 1939-40, junior engr., ore plant, and 1940 to date, senior supervisor and tech. asst. to ore plant supt., i/c development and research, Aluminum Co. of Canada, Ltd., Arvida, Que.

References: P. E. Radley, M. G. Saunders, P. M. deChazal, C. Miller, A. C. Johnston, F. T. Boutilier.

MONK—ANGUS ORR, Lieut.-Col., of Kingston, Ont. Born at Kingston, Ont., Feb. 4th, 1908. Educ.: B.Sc. (Elec.), Queen's Univ., 1935; 1925-31, patternmaker (wood), Cdn. Locomotive Co.; 1935-36, instructor, Mount Allison Univ.; 1936-40, instructor, Queen's Univ.; 1940 (7 mos.), D.O.M.E., M.D. 5, Quebec; 1941 (8 mos.), D.O.M.E., M.D. 7, Saint John, N.B.; 1943 (9 mos.), senior instructor, Armt. School, A. 21, C.O.C.T.C.; 1943-44, 2nd i/c Armt. Gp., and 1944 to date, Officer i/c Armt. Gp., Lieut.-Col. (TSO I), D.M.E., N.D.H.Q., Ottawa, Ont.

References: H. G. Thompson, E. C. Mayhew, LeS. Brodie, D. S. Ellis, A. Jackson.

MURRAY—JAMES ALBERT, of Toronto, Ont. Born at Toronto, Ont., July 2nd, 1919. Educ.: B.Arch., Univ. of Toronto, 1942; 1940-43 (part time), mech. engrg. dfting. for R. P. Allsop, consltg. engr.; 1942-43, design and detail, timber engrg.; 1943-44, chief of dfting. room staff, City Planning Board of Toronto; at present, special instructor in architectural design and constrn., and lecturer in history of modern architecture, technique of town planning, etc., School of Architecture, University of Toronto, Toronto.

References: A. E. K. Bunnell, C. F. Morrison, S. H. deJong, A. D. LePan, N. D. Wilson, W. H. Patterson.

NASMITH—DOUGLAS FORBES, of 145 Calais St., Arvida, Que. Born at Toronto, Ont., May 3rd, 1911. Educ.: B.A.Sc., Univ. of Toronto, 1933; 1933-34, chemist, Diatomite Products, Ltd.; 1934-35, demonstrator, Univ. of Toronto; 1935, chemist, Genl. Elec. Co.; 1935-41, chief chemist, Synthetic Drug Co., Toronto; 1941-42, supt., Diarsenol Co. Inc., Buffalo, N.Y.; 1942-44, supervisor, ore plant divn., and at present, new products development engr., Aluminum Co. of Canada, Arvida, Que.

References: P. E. Radley, McN. Dubose, P. M. deChazal, J. T. Nichols, G. A. Antenbring.

SCOTT—AINSWORTH DAVID, of 5481 Queen Mary Road, Montreal. Born at Kingston, Jamaica, B.W.I., Jan. 27th, 1912. Educ.: B.Eng. (Civil), McGill Univ., 1940; with the R.C.A.F. as follows: 1940-41, junior engr., constrn., 1941-42, asst. engr., constrn., 1942-44, engr. i/c constrn., B.C.; 1944 to date, group leader, wing group, aircraft structural design., Canadair, Ltd., Montreal.

References: R. DeL. French, F. M. Wood, R. E. Jamieson, G. J. Dodd.

SICK—ARTHUR EMIL, Elect. Sub-Lieut., R.C.N.V.R., of Victoria, B.C. Born at Sunnyslope, Alta., Feb. 7th, 1916. Educ.: 1944, 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); 1933-34, ap'ticeship, motion picture projectionist, also radio service shop; 1935-41, motion picture projectionist; 1940-41, service and mtce., motion picture sound equipm't.; with the R.C.N.V.R. as follows: 1941-42, elect. artificer; 1942, anti-submarine artificer (4th class) and later (3rd class) i/c naval instructional equipm't.; 1943, instructing anti-sub classes, 1943-44, chief anti-submarine artificer, i/c ships base wksp., Esquimalt, and at present, Elect. Sub-Lieut., R.C.N.V.R., H.M.C.S. Cornwallis.

References: F. H. Sexton, G. H. Burchill, J. Deane, J. J. Smith, F. N. Rhodes, W. G. Sharp.

STEWART—CHARLES GORDON, of Fort William, Ont. Born at Winnipeg, Man., Nov. 23rd, 1913. Educ.: B.Sc. (Elec.), Univ. of Man., 1936; 1938-40, assessment dept., City of Winnipeg; 1940-42, employed by Hallet & Carey, Ltd., Winnipeg, grain exporters; 1942 (summer), elec. dftsman., Bouchard Works, D.I.L.; 1942-43, elec. dftsman., design and layout of plant services, T. Pringle & Sons, Ltd.; 1943-44, engr. on elec. installn. of aircraft, and 1944 to date, supervisor, project staff, engrg. dept., Canadian Car & Foundry Co. Ltd., Fort William, Ont.

References: J. G. Welsh, C. F. Davison, J. I. Carmichael, E. P. Fetherstonhaugh, A. T. Hurter.

STEWART—ROBERT ALEXANDER, of 596 Spruce St., Winnipeg, Man. Born at Winnipeg, Feb. 29th, 1916. Educ.: B.Sc. (Elec.), Univ. of Man., 1939; 1939-40, junior engr., hydro-elec. system, City of Winnipeg; 1940, inspn. engr. on war constrn., D. Shepherd, M.E.I.C., consltg. engr., Toronto; 1941-42, junior engr., hydro-elec. system, City of Winnipeg; 1942-43, Navigation Officer, R.C.A.F.; 1943 to date, engr., City of Winnipeg Hydro-Elec. System.

References: J. W. Sanger, N. M. Hall, H. L. Briggs, G. H. Herriot, T. E. Storey, C. T. Barnes, H. Brekke.

YOUELL—LEONARD LYNDE, of Petersburg, Virginia. Born at Aylmer, Ont., Sept. 15th, 1894. Educ.: B.A.Sc., Univ. of Toronto, 1920; 1920-23, design of coal mining machy., engrg. dept., Sherbrooke, and 1923-25, sales engrg., Toronto, Canadian Ingersoll-Rand Co., Ltd.; 1925-26, asst. engr., mech. engrg. dept., Hydro-Elec. Power Commn., Toronto; 1926 to date, with the Solvay Process Co., nitrogen divn., as follows: 1926-29, engrg. divn., Syracuse, 1926-28, asst. steam engr., covering steam generation and distribution for large chem. plant, 1928-29, asst. mech. engr., handling all mech. design for this plant, 1929-30, prodn. dept., 1930 (5 mos.), purchasing dept., and 1930 to date, steam engr., engrg. divn., development dept., Hopewell, Virginia.

References: R. W. Angus, L. M. Arkley, J. R. Cockburn, C. R. Young, T. R. Loudon, W. S. Wilson, J. J. Traill, L. A. C. Lee.

LIBRARY NOTES (*Continued from page 132*)

PLASTIC MOLDING AND PLANT MANAGEMENT

By D. A. Dearle. Chemical Publishing Co., Brooklyn, New York, 1944. 196 pp., illus., charts, tables, 8¾ x 5½ in., fabrikoid, $3.50.

Although books on plastics are numerous, not much has appeared on the actual problems that arise day by day in the molding plant. The present work is intended to assist the plant operator. The construction and maintenance of molds, methods of compression and injection molding, production problems, cost control and plant management are discussed in a practical way.

PLASTICS IN THE WORLD OF TO-MORROW

By B. W. Leyson. E. P. Dutton & Co., New York, 1944. 184 pp., illus., 8¼ x 5½ in., cloth, $2.50.

A general survey of the subject, intended for non-technical readers, is provided in this book. The various plastics are described, their uses enumerated and future possibilities discussed.

PRACTICAL COURSE IN HOROLOGY

By H. C. Kelly. Manual Arts Press, Peoria, Illinois, 1944. 192 pp., diagrs., charts, tables, 7¾ x 5 in., cloth, $2.75.

Watch construction, repair and adjustment are treated in a clear manner in this textbook by an experienced watchmaker and teacher. The presentation is suitable for beginners.

PRINCIPLES OF PHYSICS (Vol. 1, Mechanics, Heat and Sound)

By F. W. Sears. Addison-Wesley Press, Cambridge 42, Mass., 1944. 526 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $5.00.

This text is based on the first course in physics given at the Massachusetts Institute of Technology. It covers the subjects, mechanics, heat and sound, which form the first year of the two-year course, and is given to students who are concurrently given a course in analytical geometry and calculus. Throughout the emphasis is on physical principles, and the calculus is used freely. Numerous problems are provided.

SIMPLIFIED TIME STUDY

By H. J. Myers. Ronald Press Co., New York, 1944. 140 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $2.50.

Intended especially for shop foremen, cost men and others who can use time studies to advantage, but to whom the results of elaborate, detailed studies are not available. Simple methods are described and basic principles are presented, with as few technicalities as possible.

STATE TAXATION OF METALLIC DEPOSITS

By W. A. Roberts. Harbard University Press, Cambridge, Mass., 1944. 400 pp., charts, tables, 9 x 6 in., cloth, $4.50.

Primarily a case study in public finance, this book deals with mine taxation over a broad period of time and with consideration of the underlying political and economic conditions. The author discusses debated principles of mine taxation, examines the aspects of mineral economics pertinent to the method of assessment and the weight of the tax, and shows the relation between the principles of taxation and the basic tenets of common law. A major part of the study is devoted to the political history of the important mining states.

SYMPOSIUM ON PLASTICS, Philadelphia District Meeting, American Society for Testing Materials, February 22-23, 1944

Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia, 1944. 200 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $1.75; cloth, $2.00.

Of the sixteen papers by authorities in the field presented in this publication, the first eight deal with such topics as the heat resistance of laminated plastics, diffusion of water through plastics, and the behavior of plastics under certain conditions and test methods. The rest of the papers are grouped together as a summary of properties, uses and salient features of the following families of plastics: phenolics, polystyrenes, urea and melamine, allyl, vinyl, cellulose, methacrylate and nylon plastics.

Employment Service Bureau

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. 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. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.

NOTICE

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 is—
(a) unemployed;
(b) 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

CIVIL ENGINEERS wanted. See page 42 of the advertising section.

GRADUATE CIVIL OR MECHANICAL ENGINEER wanted. See page 42 of the advertising section.

MECHANICAL ENGINEERS, recent graduates wanted. See pages 43 of the advertising section.

IRRIGATION ENGINEER wanted for Ceylon. See page 42 of the advertising section.

SALES ENGINEERS—large manufacturer of air handling ventilating and air conditioning equipment requires sales engineers with good technical background for industrial and contractor sales. Position would be permanent and on a salary basis. Applicants should give age, nationality, education, training and experience. Apply to Box No. 2877-V.

CONSTRUCTION SUPERINTENDENT, qualified engineer required by a large public utility company in Canada, who will take full supervisory responsibility for construction of substations of large capacity and who will also act as liaison between the company's engineering staff and the contractor. Applicants must have thorough experience in similar work. Applications in first instance should contain full personal and professional history. Apply to Box No. 2869-V.

ELECTRICAL ENGINEERS, graduates, required by a large public utility company in Canada as follows:

(a) One who is thoroughly experienced in the design of sub-stations of large capacity, making system studies, preparing cost estimates and writing specifications.

(b) One as Protection Engineer, who has thorough knowledge of modern relay equipment and its application, along with allied subjects.

Applications in first instance should contain full personal and professional history. Apply to Box No. 2870-V.

DRAUGHTSMEN AND ENGINEERS, Mechanical, electrical and concrete draughtsmen and designers wanted by pulp and paper company. Apply to Box No. 2890-V.

POST-WAR POSITION IN ENGLAND for an experienced executive with sales engineering background, preferably including export work, with a well-established, internationally-known firm of steel building products manufacturers. Senior position overseas. Desirable age limit 37-42 years. Position will require ability, tact, vision, enthusiasm and hard work. Present intention is to establish contact now with suitable applicant, although overseas move will not be made till war conditions permit. Some months of familiarization with future duties would be arranged for at a U.S.A. point. Apply to Box No. 2900-V.

GRADUATE MECHANICAL ENGINEER for post-war position, age about 35 with production and executive experience required by internationally-known firm of manufacturers of steel building products, to act in senior plant position in U.S.A. Successful candidate must be adaptable, desirous of co-operating in development of new products and production of same, and preferably with some experience in handling labour. Present purpose is to establish contact with suitable applicant with a view to prompt action when regulations permit. Apply to Box No. 2901-V.

The Institute Requires

The full-time services of a member to take charge of the rehabilitation of members now in uniform; to operate the Institute's Employment Service Bureau on a permanent basis, and to assume such other duties as may develop from time to time.

It is desirable that candidates shall have had service in this war, or as an alternative, service in the last war. The position will require residency in Montreal and considerable travelling.

Make application by letter to the President of the Institute at 2050 Mansfield Street, Montreal 2, giving an outline of recent employment experience and date as to when available. All enquiries and applications will be treated as confidential. Salary will be based upon experience and other qualifications.

SITUATIONS WANTED

MECHANICAL ENGINEER, JR.E.I.C., JR.A.S.H. & V.E., B.SC. 1936. Age 30, married. British nationality; Canadian citizenship. Experience includes four years on design, test work and sales engineering with manufacturers of complete line of fans and air handling equipment, as well as domestic and commercial heating and air conditioning equipment; one year lecturer and demonstrator in mechanical engineering at leading Canadian University; two years engineer in charge of grey iron foundry in large metal industry; two years on industrial ventilation and dust control problems, including design, experimental and development work principally on gas and dust scrubbers. Ontario location preferred. At present employed and on military postponement, but services available under regulation PC 246 Part 3, administered by W.B.T.P. Apply to Box No. 1484-W.

ENGINEER, M.E.I.C., R.P.E. (Ont.) presently employed as assistant engineer and chief draughtsman. Desires new connection due to contemplated staff reduction in a war industry. Extensive experience in structural steel and plate fabrication, miscellaneous builders' iron work and reinforced concrete as engineer and draughtsman, estimating and sales. Apply to Box No. 2208-W.

ADMINISTRATIVE ENGINEER, Civil, M.E.I.C., R.P.E. (Ont.) Toronto graduate, age 31, married. Structural supervision experience including design, maintenance, estimates, preparation of reports and specifications; administration of construction. Qualified to prepare and develop municipal and industrial plans and layouts. Available immediately. Would consider foreign assignment. Apply to Box No. 2466-W.

CIVIL AND ELECTRICAL ENGINEER, M.E.I.C., age 37, married, eight years' experience in public utility field, transmission lines, distribution systems, power sales, estimating, inspection, rates, electricity and gas. Seeks responsible position with public utility or similar organization. Registered with W.B.T.P. Available December 1st, 1944. Apply to Box No. 2469-W.

ENGINEER, B.Sc. (civil and mechanical), A.M.I.C.E., M.E.I.C., age 39, married, with eighteen years' experience in civil, mechanical, structural and chemical engineering field covering design and construction of filtration plants, industrial buildings, structural steelwork and chemical plants. Recently returned from wartime chemical plant design, construction, operation and management in Australia. Accustomed to technical development of industrial processes, supervision of operations and executive responsibility. Ready for new appointment requiring engineering qualifications combined with executive ability. Interested in permanent position with progressive chemical or industrial concern or with firm of engineers planning development. Ontario location preferred but not essential. Services are available under regulation P.C. 246, part 3, administered by W.B.T.P. Apply to Box No. 2470-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., R.P.E. (Ont.) 35 years of age, 10 years' general contracting experience; 6 years sales engineering and executive experience with manufacturer of construction materials. At present holding commission in R.C.A.F. Works and Buildings branch, desires contacts in construction field for employment in near future. Apply to Box No. 2471-W.

GRADUATE ENGINEER, M.E.I.C., R.P.E. (N.B.) with 30 years practical experience in design and construction of industrial plants, reinforced concrete, steel, timber, steam heating, water supply installation, sewerage, wharves and docking facilities, quantity and cost estimates. At present holding position of responsibility, seeks position of responsibility with industries which contemplate building or expanding. Apply to Box No. 2472-W.

RADIO ENGINEER, JR.E.I.C., A.M.I.R.E., age 26, married, desires position with a radio manufacturer as a development or test engineer. Have four years experience in radio servicing, one year in general electrical (industrial) servicing, three years in teaching of radio theory and practice and one year as a technical superintendent of radio inspection. Registered with W.B.T.P. and am available immediately. Apply to Box No. 2473-W.

Industrial News

Industrial development — new products — changes in personnel—special events—trade literature

BURLINGTON STEEL CHANGES

After spending more than three years with the Department of Munitions & Supply, Crossley W. Gale has returned to Burlington Steel Co. Ltd., as assistant sales manager.

Harlow W. Hinman has been appointed manager of tubing sales for Burlington Steel. In 1914 he established the Canadian Metal Products Ltd. at Guelph, a subsidiary of the Republic Steel Corporation. He operated this plant until 1931 when it was purchased by Burlington Steel, and Mr. Hinman joined the sales staff of the company.

Court A. Cline, who has been with the company since 1929, was appointed manager of reinforcing steel sales.

PLASTICS

Canadian Celanese Ltd., Montreal, have for distribution a 12-page folder which has been designed to show some of the many applications of plastics to civilian goods and with a view to providing designers and others with opportunities for planning for the future. The various types of plastics are treated separately with illustrations showing typical products made from each. In addition, a table of the general properties of each type of plastics is furnished. The centre spread provides in summary an organized list of the company's plastics by forms and types, sizes, colour ranges and typical uses.

C.G.E. APPOINTMENTS

H. M. Shockley was recently transferred from the apparatus sales department, head office of Canadian General Electric Co. Ltd., Toronto, to the Vancouver district office, where he will serve as central station engineer.

W. Alex. Williamson has returned to the apparatus sales department, head office of Canadian General Electric Co. Ltd., at Toronto, where he will specialize on switchgear problems. During the past seven years he was sales engineer with the company at Trail, B.C.

RECENT APPOINTMENT

Canadian Ohio Brass Co. Ltd. recently announced the appointment of R. R. Mills as district manager of the company's Niagara Falls and Toronto sales territories, with headquarters located in Niagara Falls, Ont. Mr. Mills was formerly transportation assistant of the Winnipeg Electric Company, with which organization he had been associated for the past fifteen years.

R. R. Mills

I. I. Sylvester

TRANSPORTATION SPECIALIST

Canadian General Electric Company, Limited, recently announced the appointment of I. I. Sylvester as transportation specialist attached to their Montreal office. Mr. Sylvester, it is stated, will handle the company's traction equipment business with the railways, with industrial customers, and with urban transit properties in their Montreal sales district.

Mr. Sylvester was with the C.N.R. for twenty-six years, joining in 1918 as a special apprentice. In 1940 he was appointed inspector of diesel equipment in charge of all internal combustion power plants in locomotives, stationary plants and work equipment on all C.N.R. lines. In this capacity, and formerly as special engineer in charge of Diesel engines, he was identified with many significant achievements in railroad Diesel maintenance.

CONDUIT MATERIALS

Canadian Johns-Manville Co. Ltd., Toronto, have issued a 44-page booklet, which constitutes a collation of technical data relating to the installation of conduit and ducts for electrical conductors in exposed and covered situations. The advantages and uses of the company's "Transite Conduit" and "Transite Korduct" are described in detail as are also the fittings and couplings recommended for use with these products. Considerable space is devoted to photographs and descriptions of typical installations including detailed engineering information.

KELVINATOR APPOINTMENT

The Board of Directors of Kelvinator of Canada Limited recently announced the appointment of A. V. Phillips as vice-president in charge of engineering.

Mr. Phillips has been connected with the company since 1927. His first responsibilities were in connection with the development of commercial sales engineering and refrigeration applications. In 1930 he was made chief engineer and director of quality. Prior to his entry into the refrigeration business he spent some time in the motor car industry, having been connected with the Chevrolet Motor Company in the U.S. for several years.

CONTROLS ENGLISH ELECTRIC

Announcement is made by Major James E. Hahn, D.S.O., M.C., president of John Inglis Co. Ltd., Toronto, of the acquisition by that company of a substantial stock interest and close mutual working arrangements with English Electric Co. of Canada Ltd., of St. Catharines, Ont.

"Both the Inglis company and the English Electric Co. have extensive immediate and post-war plans for supplying equipment to industry in Canada and abroad" said Major Hahn. "From an operational standpoint the products of the two companies dovetail in so nicely that it was felt a more complete and more satisfactory service could be given to manufacturers and producers through general working arrangements between the companies."

No change is intended in the individual operations or in the executive personnel of the two companies, nor in any agreements with associated companies.

EXECUTIVE VICE-PRESIDENT

C. C. Thackray has been appointed executive vice-president of Dominion Rubber Co. Ltd., according to a recent announcement.

Mr. Thackray, who was born in Ottawa, joined Dominion Rubber in 1920 and has held many responsible executive positions in the company. He was made a director of the company in 1942.

WINNIPEG OFFICE OPENED

Geo. W. Wolf, president of the United States Steel Export Company, has announced the appointment of William P. Walton as manager of the Company's Winnipeg office which is being reopened. Mr. Walton enjoys a broad background in the steel business, having represented the company as manager of its Sydney, Australia, office for many years.

DECEASED

T. B. Fordham, president of the Leland Electric Co., died suddenly on December 17th in Dayton, Ohio.

Mr. Fordham was widely known throughout the continent as an industrial engineer. Besides being president of the Leland Electric Company, he held many important executive positions with other industrial corporations in Dayton. He was also chairman of the Board of Leland Electric Canada Limited.

T. B. Fordham

THE ENGINEERING JOURNAL

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"To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."

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COVER PICTURE

The cover picture shows the Canadian Mark I Armoured Car, a Canadian-produced light armoured vehicle. Details of fabrication and welding will be found in the article appearing on page 141.

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A MESSAGE FROM THE PRESIDENT

"No wise man has a policy. A policy is the blackmail levied on the fool by the unforeseen. I am not the former and I do not believe in the latter." So said the Viceroy of India, in one of Kipling's "Plain Tales from the Hills."

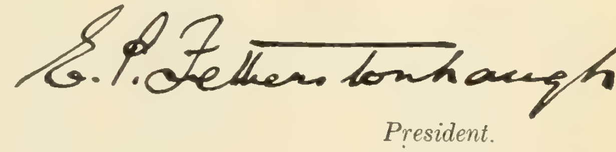
Like many other epigrammatic remarks, this is a rather clever over-statement of a fundamental truth. A policy is something that changes of necessity with changing circumstances. Certain broad principles may, however, be safely assumed as a policy for The Engineering Institute of Canada. The high ideals of the past must be sustained, the spirit of co-operation must be continued, and nothing that is in the interests of the members of the Institute must be considered unimportant.

There can be no let-up in the efforts that have been put forth in the past five years by the Institute as a body, and by its members individually in their engineering contributions towards the winning of the war. In spite of favourable news from the battlefront, this is a time to tighten our belts and to go into the last lap with unabated zeal and determination. We are faced by a skilled and relentless foe, and he will bring into this final stage of the battle all the clever and ingenious devices that his highly organized scientific and engineering staffs can invent and develop. By intensive and continuing research, development, manufacture and transportation, we must, as engineers, keep ahead of him in this gruesome race, until the last shot has been fired and Victory has been won. We can do it and, if we have a policy to lay down, let it be—"We will do it."

But, in spite of our necessary preoccupation with the engineering problems of the war, it will be our duty to exercise all possible foresight and imagination in furthering plans already laid for the post-war period. Here again, the engineer has a notable part to play: in the development of post-war projects; in assisting returning engineers to adjust themselves into peacetime occupations; and in the training of those whose engineering education has been interrupted.

With its great prestige, its wide-spread membership, and its fine traditions, The Engineering Institute of Canada is well adapted to play a notable part in these spheres of war and peace, and I look forward with confidence to a busy and fruitful year for your Council and Committees.

You have conferred on me a high honour, by electing me to the Presidency of the Institute for the coming year. I deeply appreciate that honour, and I trust that I may be able to carry out to your satisfaction the accompanying responsibilities.



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THE WELDING AND FABRICATION OF CANADIAN LIGHT ARMOUR

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Introduction

The term "light armour" may be employed in two ways. It may refer to either the lighter thicknesses of armour plate or to the lightly armoured vehicles themselves, in which latter sense the term "light armour" is used by the newspapers. This article will deal with the welding of light armour in the first sense and the fabrication of the light armoured vehicle hull in the second sense.

In considering the problems relating to the welding and fabrication of light armour plate, it is necessary that we first review the developments in this field. The practice which existed in the manufacture of the pre-war armoured vehicles has in part served as a foundation for the present practices. At the beginning of the war there was little or no information on the welding of armour plate. The practices usual at that time involved the use of a bolted and riveted design.

History

The first light armoured vehicles and, for that matter, the heavier type vehicles such as tanks, were constructed primarily with one or other of two types of armour, this armour being bolted or riveted on to a mild steel framework consisting of strips and angles. The armour used was either of the so-called face-hardened type or of what is known as a homo-hardened type. The first type is primarily a hardened plate of approximately 400 Brinell hardness, having one side carburized and hardened to approximately 600 Brinell, this hardened face being presented to the projectile attack. The second type, or homogeneous hardened type, is, as the name implies, an armour of uniform carbon content and hardness throughout its thickness, the Brinell hardness being about 450.

It is easy to visualize the difficulties which occurred in the machining and fabrication of these types of armour. Other difficulties were encountered in this type of construction, namely, the fact that the gaps between adjacent plates had to be held to very close limits in order to resist attack with solid core projectiles and to guard against molten lead splash from the ordinary ball type ammunition.

The objection to the use of welding at this period of armour vehicle construction was mainly due to the effect of the welding heat on the plate, which brought forth two problems. The first problem was that of avoiding cracks to which this high alloy type of armour plate was prone, due to its high hardenability. The second problem was presented by the softening effect of the welding heat in the adjacent parent plate zones which it was felt would tend to lessen their ballistic immunity.

Description of Weld Zone

It seems desirable to mention the different zones which exist near any ferrous weld. Figure 1 shows a section through a single pass butt type joint in 12 mm. bullet proof armour plate which was made by an automatic electric arc welding process. Examination of the figure will show that, progressing from the deposited metal to the parent plate structure, a number of complex heat affected zones are encountered in the weld adjacent armour plate. The first zone, adjacent to the deposited weld metal, is what is called the coarsened zone, the structure being relatively coarse due to the high heat (2,500 deg. F.) which this section of the parent metal has attained. This zone is also a hardened zone but, due to its proximity to the molten weld metal favouring slow cooling rates, it will not possess the maximum hardness encountered in the weld section. The next zone is called the hardened zone and, like the first, has been above the critical temperature, and it is here that the highest hardness is reached (in this type of armour plate up to 550 Brinell). The structures found in these first two zones in the case of armour plate weldments are mainly martensitic and thus inherently hard and brittle. It is the aim, if possible, to minimize the width and extent of these zones by the use of proper welding procedure and technique.

The next zone which is encountered is termed the softened zone or, in other words, the adjacent parent metal which has reached a temperature ranging from the critical temperature down to the maximum temperature which was reached in the drawing of the parent

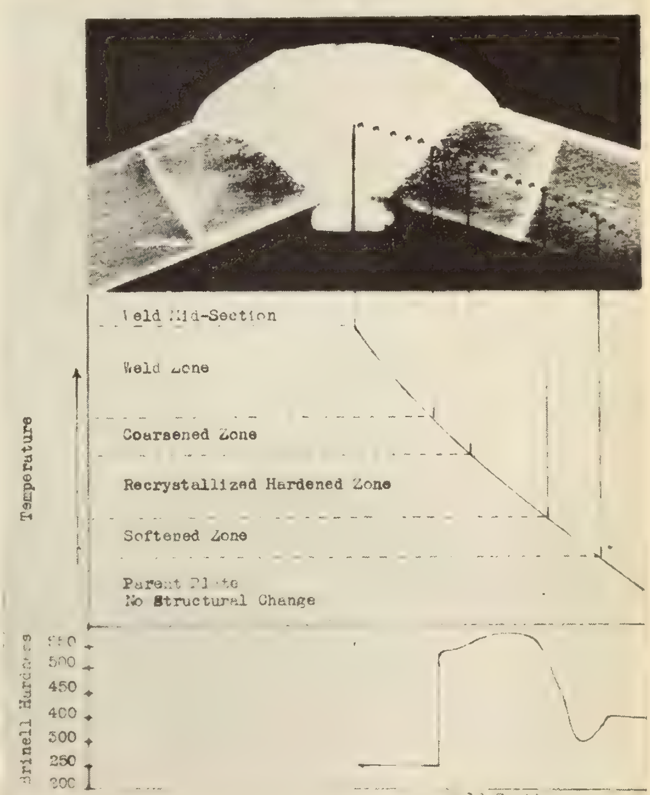

Fig. 1—Weld section showing principal zones and hardness in adjacent armour plate.

plate during heat treatment. This zone in light armour plate weldments will show hardness as low as 290 Brinell and its extent must be minimized as much as possible in order that the ballistic properties of the weld zone may be maintained. The hardness graph in Fig. 1 shows the different hardness levels encountered in the different adjacent heat affected zones just described.

The above description of the weld zones is typical in part of all welds made on armour plate or, for that matter, any hardenable grade of steel, whether we are considering multiple pass manual arc welding or automatic single pass arc welding.

Problems Encountered in Welding Armour

While stating what is required of these armour weldments it will be well to study briefly the major difficulties encountered. In the making of a weld between two armour plates, the weld must meet a ballistic specification which is governed by the thickness of the plate being joined and the angle of projectile attack to which it will be subjected. The weld must also have sufficient structural strength to withstand the stresses which will be imposed in normal service. In the first case, sufficient excess weld metal build-up, weld soundness and weld hardness must be maintained to afford the same ballistic immunity as the thickness of the parent plate being joined. In the second case, it is necessary to ensure sound welds and maintain the desired physical properties of the weld and weld adjacent zones. In aiming to meet both these requirements, one of the main difficulties met with was that of preventing the formation and propagation of cracks in the heat affected parent plate zones just described.

Our present knowledge of crack formation is limited to a large but unrelated mass of information which has been gained by ourselves and many other observers. In order to fully understand the complexity of the problem, we will mention the main factors which are known to be important in the production or, inversely, the elimination of cracks. The two main types of variables may be classified under the heading of "external" factors and "internal" factors. The external factors are those which it is possible to control directly and include plate composition, thickness and temperatures; the dimensions of the groove; the rigidity or external restraint of the joint; the composition, temperature and coating of the electrode; and the welding voltage, current and speed. The internal factors are those variables which we may class as not being directly under control and include the cooling rate of the weld zone; depth of weld metal penetration; thickness and contour of the weld bead; the stress distribution as governed by the external restraint; rates of speed of freezing and cooling; joint geometry; and the composition of the fused weld metal as governed by the dilution or per cent admixture of the deposited metal by the parent plate material. In addition, there are so-called inherent factors which are beyond experimental control and which are represented by the thermal diffusivity, physical properties, the range of temperature through which the weld zone passes, and the allotropic transformation of the steel.

It will be seen that many such variables must be dealt with in any investigation which aims to develop the best overall welding conditions. It should also be appreciated that elaborate and painstaking tests must be conducted in order to segregate and eliminate the causes, say, of weld cracking. In actual weld testing of mild steel weldments, it is generally necessary to perform only the usual physical tests. However, when one is dealing with high tensile type steels having latent high hardenabilities, it is also necessary to supplement the ordinary physical weld tests with a test or series of tests which will measure the tendency of a certain parent plate material or welding technique to produce cracks in the weldment. There are numerous tests of this type, in which the test specimen to be welded is held under restraint during and after the welding cycle. The number and complexity of these tests prevents their discussion in full. However, one such test, the R.D. Rigid Butt test, is shown in Fig. 2. It is possible in this test to vary conditions of restraint and cooling cycle while using different plate materials, welding rod types, and welding procedures or techniques. In other

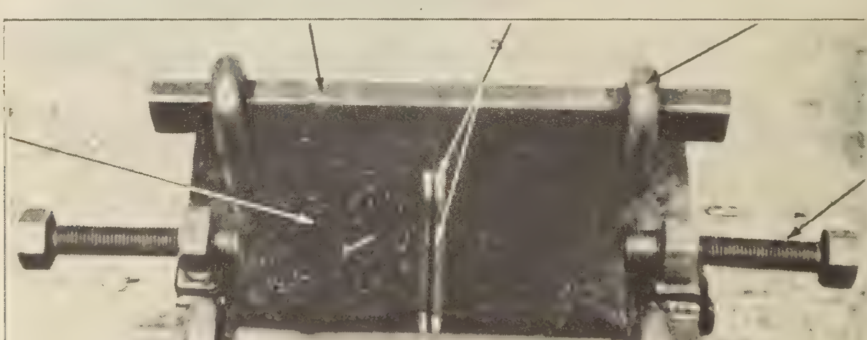

Fig. 2—R.D. Rigid butt test.

Weld metal crack   Fusion zone crack   Adjacent zone crack

Fig. 3—Three main types of weld section cracks—All samples etched with 3% nitric acid.

words, it is possible to vary the "external" and, to a degree, the "internal" factors in a test weld and study their effects.

Cracks which are encountered in armour plate welding are of three main types and are illustrated in Fig. 3: first, weld cracks, i.e., cracks in the weld metal; second, fusion zone cracks, or cracks occurring at the interface of the weld metal and the parent metal; and third, cracks occurring in the parent metal of the heat-affected adjacent zone. Fusion zone cracks are probably the most important and merit considerable attention. In these cases, fracture occurs within the very narrow region located at the welded edge of the armour plate without any direct relation to a particular microstructure or hardness pattern; this indicates that the distribution of internal stresses may be accountable for the crack formation. The coefficient of linear expansion is approximately 40 per cent greater in the case of the austenitic stainless weld metal normally used than in that of the parent armour plate which we are welding. After the joining of these two metals by means of welding, any decrease in temperature will result in the development of shear stresses at their junction or interface due to the restraint of contraction imposed upon the austenitic weld metal by the adjoining ferritic armour plate. This condition tends to favour the possibility of cracking which is already favoured by the adjacent brittle martensitic zone in the armour plate. This explains the tendency towards adjacent failure which is encountered in the ballistic testing of these welds and practically forbids the maintenance of 100 per cent ballistic immunity in the weld zone.

Types of Armour Plate

In order to explain the difficulties encountered in the welding of the homo-hard armour, we will next consider its general properties. This armour plate is made from a steel containing a considerable quantity of alloy together with a medium carbon content. This results in a steel possessing a high hardenability. Briefly defined, the hardenability of a steel is that property which will allow it to harden throughout the section (thickness) being considered upon cooling to room temperature from above the critical temperature (1,500 deg. F.). In the heat treatment of steel this cooling is generally accomplished by quenching it in water or oil, whereas in welding, the weld zones heated above the critical temperature are quenched by the heat transfer effect occasioned by the mass effect of the parent plate. Hardenability is obtained by the addition of controlled percentages of carbon and hardening alloy elements to the steel. The percentage carbon content largely controls the maximum hardness level which may be reached, by allowing the formation of hard carbide constituents, while alloy additions such as chromium, manganese and molybdenum slow up the structural transformation of the steel by depressing the critical cooling rate, i.e., the minimum cooling rate needed to induce full hardening.

High hardenability is needed to impart hardnesses ranging from 400 to 450 Brinell in this homo-hard type of plate. A plate of this hardness, while excellent against a small calibre attack with armour piercing projectiles, possesses the undesirable habit of shattering when overmatching attack with larger calibre projectiles is encountered. This is a feature which is common to German armour plate but is considered highly undesirable by Allied designers. The other undesirable feature, as mentioned above, which this armour plate possesses is that, due to the high inherent hardenability, the presence of extremely high hardnesses in weld adjacent zones makes for the propagation of weld cracks and cracks in the adjacent parent plate zone.

In order to allow for the total use of welding in the fabrication of an armoured hull, another type of armour was developed. This armour was to possess in addition the ability to withstand overmatching attack without shattering. This armour came to be known as machinable quality homogeneous armour and possessed a heat treated hardness of approximately 350 Brinell. Since the upper limit of practical machinability is approximately 400 Brinell, this hardness of armour allowed for mass production and manufacture on a comparatively economical basis when compared to the problems met with in trying to machine the earlier, harder types of armour used. Since a lower hardness was specified to give machinability, it was also possible to lower the percentage of alloying elements and in this way decrease the hardenability of this steel to the point where welding could be practised with fewer cracking difficulties in the weld and weld adjacent zones. It was found that it was possible to completely weld an armoured hull from this new type of armour plate, and the use of a mild steel framework with the accompanying use of rivets and bolts was eliminated. This resulted immediately in improvements in weight reduction, release of processing machines, added ballistic protection and saving in labour.

Initial Canadian Welding Development

It was at this stage of development that Canadian manufacturers were called upon to produce fighting vehicles using light armour (4-17 mm.). Since the United States had been doing no work of this kind, information was not available from this source. The only information which was obtainable from the United

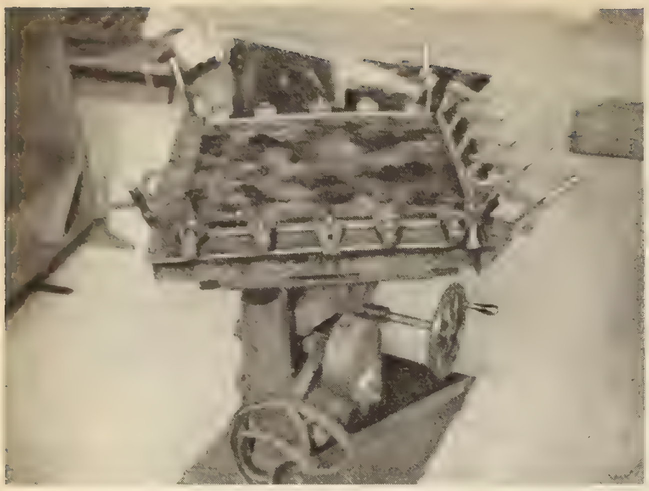

Fig. 4—Note prebending induced in plate during welding of strip to edges of plate.

Kingdom was to the effect that it was possible to weld light homogeneous armour satisfactorily using stainless type electrodes, the process being that known as D.C. manual arc welding.

The property which makes the stainless type electrode suitable for the welding of armour plate is the ability of the weld metal to remain in the austenitic state on cooling, which austenitic state or structure possesses the necessary strength and, what is more important, ductility, to absorb the severe contractional stresses during cooling of the weld section. Since the tensile strength of the armour plate is over three times that of structural grade mild steel, it will be appreciated that a ductile weld metal is needed to absorb the expansional and contractional stresses induced by the welding heat.

Since it was of prime importance that the Canadian armoured car programme be started without delay, it was necessary to find a suitable type and make of stainless electrode and develop as soon as possible a satisfactory welding procedure and technique which would permit the fabrication of ballistically and structurally sound welded armour hulls. The only information available on the stainless electrode used was to the effect that three methods of welding were practised. The first method used the so-called 25-20 (25 per cent chrome—20 per cent nickel) type stainless electrode, but the difficulty we found was that, due to the low hardness (180 Brinell) of the weld deposit, it was impossible to maintain the ballistic properties of the weld zone. The second type of weld recommended was that in which all the passes in the vee were deposited with a 25-20 electrode and the crown bead, which was exposed to ballistic attack, was deposited with a hard-surfacing type electrode in order to resist projectile penetration. It was found that excessive cracking of this hard facing weld metal took place and this method was discarded. The third method of making a weld employed an 18-8 (18 per cent chrome-8 per cent nickel) type stainless electrode giving a harder weld deposit (210 Brinell) and after many experiments with welding procedures and welding techniques, it was found possible to produce ballistically and structurally satisfactory welds with the weld joint designs prescribed at that time.

After we had found out how to make satisfactory weldments with the 18-8 stainless type welding rod, studies were made of the factors relating to joint design from the point of view of increasing the overall physical properties of the welds. It was found that in a butt type joint a 60 deg. vee angle represented the ideal. In the preparation of plate edges which formed a particular joint, the natural angle of the vee so formed was considered. Where the vee angle so formed did not fall below 50 deg., no plate edge preparation was carried out. It was found that a smaller vee angle than the above figure tended to produce unsound welds, while, on the other hand, if a vee angle of 60 deg. was exceeded, the greater area of soft weld metal so presented made for increased ballistic failures, while at the same time having a greater consumption of expensive weld material. In cases where the natural vee angle exceeds 60 deg., as in the case of the 90 deg. full open corner joint, there is no alternative but to use this type of joint design with adequate build-up of the crown bead.

Space does not allow us to describe in detail the many procedures and techniques which were developed to ensure satisfactory armour plate welds. It is sufficient to say that for the most part good mild steel welding techniques and procedures must be adhered to in the welding of armour plate. The main difference between the welding of these two types of steel is that, in the case of the armour plate welding, the welding heat and heat input into the adjacent zone must be maintained as low as possible. The reason for limiting this heat is to prevent excessively wide heat-affected zones in the parent plate and excessive admixture of the plate metal with the deposited weld metal, both of which conditions make for crack formation and ballistic failure.

Alloy Conservation

About this time in the development of Canadian armour plate welding, the alloy shortage was becoming increasingly severe. The stainless rod which we were using possessed a total of about 33 per cent alloy, these alloys being chromium, nickel, molybdenum and man-

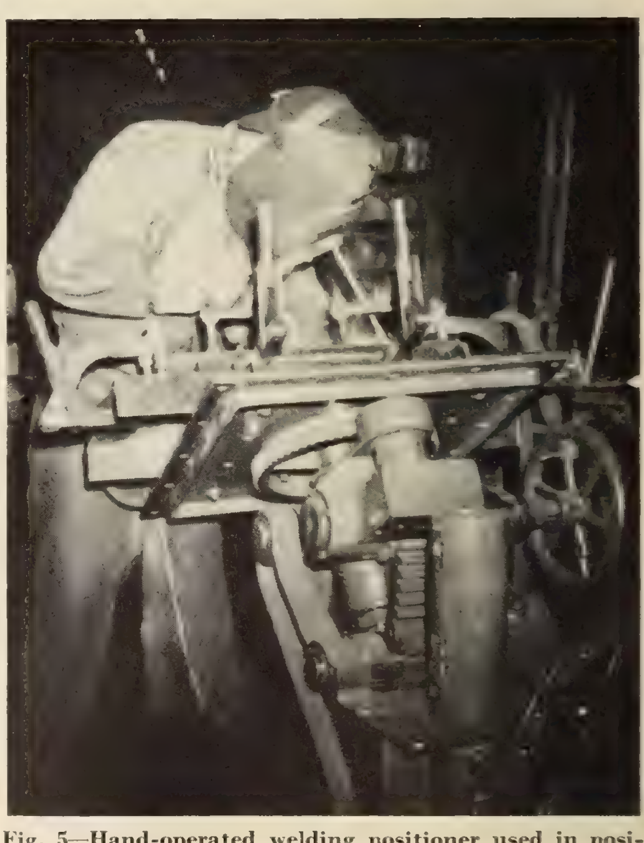

Fig. 5—Hand-operated welding positioner used in positioning small sub-assembly weldments.

ganese. Considerable work was carried out to develop or discover a welding technique or type of welding electrode which would allow the joining of armour plate with a less expensive weld metal. It was found that insofar as ballistic requirements were concerned, it was possible to produce ballistically sound butt welds welded with mild steel electrodes. It was not, however, possible to ensure a production of crack-free weldments on a practical production basis when butt type or corner type joints were involved. It was, however, established that straight polarity mild steel electrodes of the AWS E6012 variety could be used satisfactorily in the welding of fillet and lap type joints with no danger of lowering the ballistic or structural requirements of the vehicle. It was also found practical to use mild steel electrodes when depositing the sealer bead or back bead on the stainless welded butt and corner type joints. The substitution effected in the use of mild steel in place of stainless electrodes was found possible to the extent of 35 per cent in the case of the two armoured cars being made at that time. Where effected, this substitution cut the cost of weld metal by 90 per cent, while at the same time conserving critical alloys.

The main precaution in regard to the use of mild steel rod was that, as in the case of the stainless, the penetration and welding current (heat) must be kept to the minimum compatible with the production of sound welds, in order that excessive dilution of the ductile deposited weld could be avoided. The use of mild steel welding on armour plate was limited for the most part to outside attachments and those inside attachments which allowed at least 8 inches of continuous welding. The reason for this was that the mild steel weld was not as capable of withstanding the impact of ball ammunition when the attack was on the opposite side of the plate from the weld. This is explained by the great difference in ductility of the two types of deposited weld metal, i.e., mild steel and stainless with 2-inch gauge length elongations of 20 per cent and 45 per cent respectively.

The next major step in connection with welding of armour plate was the development of the so-called ferritic type electrode. This electrode was of the so-called high tensile type and differed from the commercial grades in that it possessed a lime type coating such as that used on the stainless electrodes. The percentage of alloy was only about 3 per cent and a saving in cost of roughly 50 per cent resulted. This electrode was developed in the United States and had limited application to the welding of butt type and corner type joints. It was tried in Canada and, while not found suitable for these butt type joints, it did find some application to fillet welds in places where the use of mild steel was prohibited. A saving of 10 per cent in stainless electrode usage was made by the substitution of this ferritic electrode on one vehicle being welded at that time.

Automatic Arc Welding

While manual arc welding of armour plate has proved to be the most advantageous type of welding to use in many cases, the automatic type of welding, which is also known as the submerged melt type of welding, has also proved applicable to armour plate. The automatic type of welding has the advantage that in many cases the use of one welding pass may be substituted for three or four passes of hand welding, while at the same time employing an electrode travel speed upwards of 50 per cent higher than can be used by the manual method. Up to the time that armour plate welding was undertaken in Canada, no automatic welding of armour plate had been attempted anywhere. One Canadian company, however, took the big step of applying this process to one armoured vehicle which they were making. Since the rule of the day was to use an austenitic core wire in welding armour, the first vehicles produced by this welding method employed the stainless type of rod. It was soon found that unsound welds occurred when using this type of rod and that transverse weld cracking was encountered due to the high shrinkage stresses and also due to the embrittlement of the weld metal which took place. This embrittlement was due, in part, to the extremely deep penetration which is characteristic of this process and which results in upwards of 60 per cent dilution of the weld metal by the parent plate thus destroying the ductile nature of the intended austenitic weld metal. It was quite obvious that a ferritic or mild steel type of electrode was required and, after considerable experimentation, it was found that a mild steel core wire containing small additions of manganese and molybdenum made it possible to produce a weld which approached the physical properties of the parent armour plate.

The main considerations in this automatic type of welding are that the joint fit-up must be held to closely specified limits and that the welding procedure must be closely controlled to give the correct percentage of parent plate admixture and controlled cooling rates in the weld adjacent plate zones. It was found that exces-

Fig. 6—Large motor-operated positioner for handling major hull assemblies.

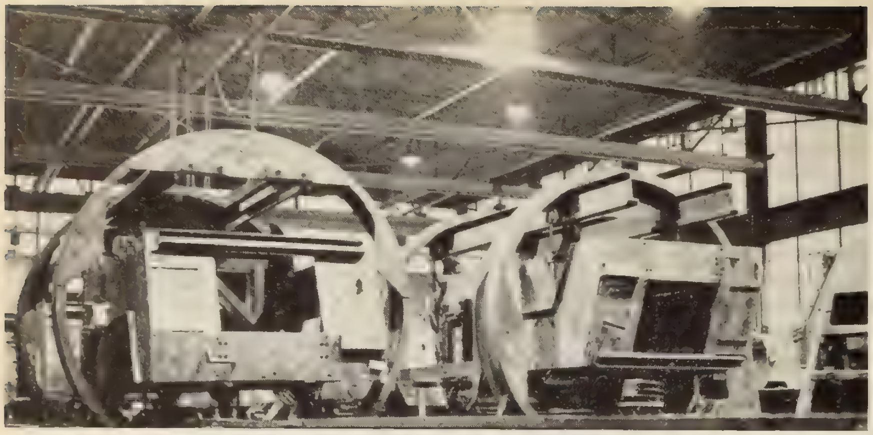

Fig. 7—Roll-over positioner used on production line.

sive admixture of the parent plate with the weld metal gave excessively hard welds, which though possessing particularly good ballistic resistance, tended to produce severe weld cracking due to the extremely low ductility factor. One advantage which the ferritic weld had was that, due to the co-efficient of expansion being approximately the same for the weld metal and the parent plate, the weldments gave extremely good ballistic results under impact with explosive or overmatching projectiles. It is not out of the way to say that Canada pioneered in the development of the submerged melt type welding of armour plate.

Fabrication Methods

Considerable difference exists between the working and fabrication of mild steel and armour plate, the latter material actually being a high tensile type of steel which has been heat treated to impart the necessary physical properties to enable it to withstand ballistic attack. When it is remembered that the structural grade of mild steel possesses a tensile strength averaging 65,000 lb. per sq. in. and a ductility, as measured by elongation, of about 35 per cent in a 2-in. gauge length as against the armour plate which possesses a tensile strength of approximately 180,000 lb. per sq. in. and a ductility of only 12 per cent, it will be realized that we are dealing with properties in the latter case which approach those of a spring steel.

After the flame cutting of plates which are designated for subsequent welding, it is necessary to employ a straightening operation so that flat plate surfaces and good weld-fit-ups can be obtained. In the welding of armour plate assemblies, as in the case of mild steel, considerable distortion and locked-up stresses are introduced into the weldment. When the initial fabrication was begun, it was soon realized that adequate clamping and holding of the assemblies to be welded was a primary prerequisite. This necessitated reinforced welding fixtures and extremely heavy clamps. Due to the high yield strength of the material, there was considerable difficulty in straightening assemblies after welding and, wherever possible and allowable, prebending of the assemblies during welding was used. Figure 4 shows one such jig in which a square door is prebent during welding of splash strips around its edges. It was a case of considering every assembly as a separate problem and, by trial and error, construction of the jig was undertaken to produce a finished product containing the least possible amount of locked-up stresses and warpage.

In the manufacture of the jigs, two primary requirements had to be met. First of all, due to the shrinkage of assemblies after welding, it was necessary to allow for this in the jig so that the weldment could be freely removed after welding. It was also necessary, wherever possible, to allow for positioning of the assemblies so that flat or horizontal welding positions could be used. The reason for this latter requirement was that, due to the shortage of good welding operators, the best welding conditions were required in order that quality welding could be maintained. There is also the other problem that the different operating characteristics of the stainless type electrode necessitated that, wherever possible, the trough or down-hand type of welding position should be allowed.

Hand-operated positioners such as shown in Fig. 5 were used to position the smaller welded sub-assemblies. Large assemblies were positioned by large motor-driven positioners working on the same principle as the smaller hand-operated ones. One such motor-driven positioner is shown in Fig. 6. Positioning on the production line was done in "roll-overs" such as shown in Fig. 7, in which the whole armour hull could be positioned around a horizontal axis.

In all phases of the straightening and fitting of assemblies, added difficulty was encountered due to the higher strength and springiness of the armour plate, and special tools and methods had to be developed to meet this problem. These problems were multiplied due to the close tolerances of fit between doors and door frames, etc., in order to afford adequate protection against lead splash.

Other Problems

One of the main difficulties which had to be met and which was always on hand was that of obtaining weld-

Canadian Mark 1 Reconnaissance Car.

ers for armour plate welding. Since in all other fields welding was becoming increasingly popular, a great strain was placed on the available welder capacity and, to counteract this, training schemes and welding schools had to be introduced. Hitherto it had always been claimed that it took years to produce a good welding operator and we found that this was, in a sense, correct. It was found possible, however, by the use of intensive instruction and a simplified training scheme to train a green man in a period of four weeks to a state of competence which would allow him to produce quality work on simple sub-assembly welding. Depending on their aptitude, it has been found possible to allow welding school graduates to work on major sub-assemblies three to six months after graduating from the welding school. It is perhaps of interest to mention that, at one time, 50 per cent of the welding school enrolment was composed of women, who, in some cases, proved to be better than men in acquiring welding technique.

ACKNOWLEDGMENTS

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Acknowledgment is also made of the valuable work contributed by Dr. Gordon E. Willey who preceded the author in the initial stages of the fellowship.

The author is also indebted to the Hamilton Bridge Company for the photographs included in this paper.

THE NEED OF RESEARCH IN CANADA

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An address delivered at the President's Dinner on the occasion of the Fifty-Ninth Annual General Meeting of The Engineering Institute of Canada in Winnipeg, Man., on February 6th, 1945

A year ago at the Annual Meeting in Quebec City, Dr. C. J. Mackenzie, now president of the National Research Council presented a paper which, in my opinion was of the greatest import, important because it dealt with one of the most fundamental and significant problems facing Canadians to-day: Research.

No apology is offered for the appearance of a few more remarks on the subject, in spite of the many excellent and thought-provoking contributions by eminently qualified writers on this theme. It is my wish to emphasize the situation, even though by repetition, in order to keep this vital subject in the public mind.

Of the many phases of research and the varied fields, such as the academic, the social, the economic, the engineering and the industrial, in which it is carried on, valid considerations preclude detailed treatment of the subject here, nor do they permit of anything but a casual reference to the overlapping of almost all of these areas. But there are certain aspects of the subject which do merit the sober consideration of all thinking Canadians. These, it is my intention, with your indulgence, to present briefly here.

It will be taken as axiomatic that because of the legitimate publicity now given to research, the day is past when any question is raised as to the need for industrial research or any other kind of research; and that these are commonly accepted as necessary items in the budgets of governments and government agencies, universities, and enlightened financial and industrial corporations.

PRESENT STATUS

The marked impetus given to scientific research throughout the world by the last war was not proportionately felt in Canada. With the exception of a few Canadian companies whose contributions to the war resulted in research, in an effort to convert to civilian use certain processes and products born of the last war, Canadian industry and the engineering fraternity in general failed to be inoculated. From the national standpoint, the National Research Council came into being at this time.

Nor did conditions change markedly during the quarter century following the first world war. Apart from the contributions of university and government laboratories, Canadian industry, with a few notable exceptions, was existing on "technological blood-transfusions" from Great Britain and the United States. It is, therefore, of distinct interest to note the expansion of research in Canada, both in government and in industrial circles since the beginning of the present war in 1939.

COMPARATIVE NATIONAL EXPENDITURES ON RESEARCH

We are indebted to President Mackenzie for the following figures presented in his paper of a year ago—the paper which serves as the justification for the present effort. These figures show the estimated expenditures on research in Russia, the United States, Great Britain and Canada on a per capita basis and as a percentage of the national income. The year of estimate is also given.

Country	Year	Annual exp. on research in millions	Per capita expenditure	Percent of est'd national income
		$	$	
Russia	1934	300-500	1.80-3.00	0.8-1
United States	1935	300	2.40	0.5-0.6
Great Britain	1934	30	0.70	0.15
Canada	1938	2.4-3.3	0.22-0.29	0.06-0.08

Dr. Mackenzie stresses the fact that "it is impossible to obtain anything more than approximate figures as there are few official statistics available and, further, the word research is often used loosely to cover routine testing, plant control, and similar activities." Notwithstanding this and admitting the difficulties of correctly estimating the population of a country such as Russia, it is believed that the above figures, taken as they were from reliable sources represent at least the proper order of magnitude of the expenditures on what can be properly called scientific and industrial research in the countries shown. He continues "Even approximate figures for Germany, Japan, France and Italy are difficult to get for the corresponding periods, but it is safe to assume the expenditures in Germany approximate those of the United States, and that she is still leading in organized research." Of Japan, Bernal (The Social Function of Science, 1939) says: "Industrial and government laboratories and institutes in Japan are probably larger, better financed and organized in relation to the wealth of the community than in any other part of the world."

While comparisons are always odious, it will be healthy to consider somewhat further the significance of the above figures and it should be remembered that the ultimate value of research must be measured in terms of effectiveness and efficiency as well as in terms of total expenditure. It seems reasonable to assume that Russia, Germany, the United States and Japan were all devoting relatively large per capita amounts of their pre-war income to research; that Great Britain was far behind quantitatively although it is known that quality was very high; that France and Italy were well down in the scale in comparison to Britain; and that Canada, on any proportional basis either of population or of national income, was spending not more than one-eighth to one-tenth of the amounts spent by Russia and the United States, and probably not more than one-third of Great Britain's expenditure. Although Canada's population is one-tenth that of the United States, its total research expenditures were only one-hundredth; Great Britain's total expenditure was over ten times Canada's although its population is only four-fold.

Again may we quote Dr. Mackenzie: "While Canadian industry has, in the present war, an excellent record in war production and has shown skill and competence of a high order in manufacture, I think few would deny that if Canada had been cut off from the complete exchange of scientific and technical knowledge which was available from Great Britain and the United States, our contributions to this war would have been much as they were in the last one—superb front line fighting soldiers and the supply of simpler munitions such as shells and explosives—and our effectiveness as a self contained independent fighting nation would have co-related fairly well with our peace-time expenditure or research."

It may be further noted that while private industry in Great Britain in 1934 was responsible for about 33 per cent of the total national expenditure on research, the corresponding figure for Canada in 1938 is only 5 to 7 percent. These figures provide ample scope for consideration by thinking Canadians as to what is to be Canada's position in the post-war picture as an independent nation, self-contained and something more than an exporter of raw materials to the outside world.

Canada's Present Capacity for Research

And what is Canada's present capacity for research ? Let us consider the raw materials required to maintain an effective research programme in this country. First, and of fundamental importance, comes the research personnel. Since the beginning of the present war there has been, and there still is, a definite shortage of trained scientific workers in Canada.

The situation in the United States which has its exact parallel in Canada was presented by the late Thomas Midgley Jr., president of the American Chemical Society, on October 5th last in New York. Referring to the chemist's view of the future of industrial research, he stated that probably no other field holds more and varied promise for successful industrial research than chemistry; success for the investigator who may satisfy his curiosity about the unknown with a fair share of honour and wealth; success for industry (and when I say industry, I include the engineering profession, for the two are completely complementary) which may increase its payrolls, its output and its profits; and success for the public who will reap the benefits of better health, higher standards of living and a safer world in which to live.

As to the lack of properly trained personnel in chemical fields, he points out that the war has already eliminated three years of the normal supply of college graduates (in the United States), and if the upsurge of research takes place, which we all hope for, after the return of peace, we will find ourselves very short of professional chemists and chemical engineers. There will almost certainly be a decided rise in salaries as competitive industry again gets under way. This will not be bad for the chemists who are already in industrial work, but its repercussions on the educational situation may be quite disastrous. The universities are in no position to bid financially for the services of the younger men who are needed as instructors, later as assistants and associate professors, and later still as full professors and heads of departments.

Industry and the professions should take heed of this situation before it gets out of hand. By ample fellowships both in size and number they should encourage many young men to remain in educational work in order that their own full need can be met in the near future.

This shortage of scientific personnel in Canada has been somewhat ameliorated by the work of that branch of the Department of Labour known as the Wartime Bureau of Technical Personnel, a bureau created to administer the register of scientifically trained persons in the Dominion, and a special register, under Dr. Keyes, of those especially qualified to do research. This Bureau has the power, if necessary, to transfer, for the duration, scientists from non-essential to essential war work. The term 'technical personnel' is a misnomer and confusing. It had been better called the 'Bureau of Scientifically Trained Personnel', with a minimum registration requirement of graduation from a recognized university.

Figures released by this bureau give, on an annual basis, the number of scientifically trained graduates from all Canadian universities at the present time as 1,700. Of these about 300 to 350 are women with domestic sciences only to their credit. Of the whole group, approximately 1,200 are claimed on priority by the armed services, leaving 500 (including the women graduates) for other fields. Statistics show further that approximately 500 of the technical personnel of the Dominion either die, retire or become otherwise removed from the field, leaving an actual annual deficit to supply the demands of industry, even though engaged in war work. Hence the shortage.

Further there are only a limited number of Canadian universities which offer strong postgraduate courses leading to the Ph.D. degree. This situation can scarcely be looked upon as a sound basis for an enlarged national research programme, especially in the chemical field. Actually, the shortage is more acute in the field of physics and of electrical and mechanical engineering. Again, and this is an old story, our better trained scientific men still migrate to the United States, attracted there by the much higher salaries paid even to recent graduates without engineering or industrial experience. This flow has been somewhat controlled by the W.B.T.P. but even so, many good men have been lost to Canadian industry and Canadian laboratories since the beginning of the war.

In the second place, a consideration of the special tools of modern research is indicated. These may be obtained, and their acquisition, maintenance and operation is a considerable factor in the research budget. The advent of these intricate tools requires specialists not only for their use, but also for their further improvement, development and the proper interpretation of their results. A number of examples might be chosen; the spectrograph for analytical work both qualitative and quantitative, X-ray and electron diffraction equipment for structural analysis, the infra-red spectrophotometer for the analysis of organic molecular structure, and the electron microscope. Any one of these can be set up and used in a routine way by a high grade technician, but to realize its full value and to fully exploit its possibilities in solving new problems requires research investigators of the highest calibre.

These and other considerations face us if we are to implement the will to have Canada maintain and improve her position in the post-war world. She is blessed with an abundance of the raw materials provided by nature, but it would be shortsighted policy indeed not to realize that these are exhaustible, and make no plans to supplement them by the utilization of wastes and the application of modern scientific knowledge to this end. To depend on these resources alone would be suicidal. And this seems to be the point at which a simple but pregnant question might be asked. What, during the year that has passed, has been done in Canada, or (to bring it closer to home) by the Engineering Institute, in the way of consideration of Dr. Mackenzie's splendid challenge to the Canadian government, Canadian industry and the scientific personnel of our Dominion?

Has the Institute met this challenge?

And finally, to end on a more optimistic note, and to answer the inevitable question "But what is the use of it all?" may we consider very briefly some of the present day results of past research and their implications?

The Results of Research

This is well put in the words of Redmond and Mory[1]. "Are we appreciative of the benefits of electricity, that faithful servant that provides a light, a cooling breeze, or power for chilling cold as we decree? that toasts our bread, irons our clothes and runs the furnace that keeps us warm? That with the swiftness of light carries to the far ends of the earth our written and our spoken word. Then let us not forget Gilbert, Volta and those who came after, and more especially Faraday. It was none less than Gladstone who naively enquired of Faraday 'But after all, what use is it?' Then Faraday's rejointer: 'Why Sir, there is every probability that you will soon be able to tax it'." Considering the gross receipts from the distribution of electric current in Canada in 1944 the presumption is that to-day's public revenue from the outgrowth of Faraday's researches would have astonished Gladstone as much as it interests Mr. Ilsley.

"Do we take pleasure in the materials that add to beauty and comfort—the pleasing hues of raiment? It was Perkin who introduced to us the brilliant colors that lurk in coal tar awaiting the fairy wand of chemical research, and Woehler who removed the veil that hid from our eyes the limitless possibilities of organic synthesis." It was Bakeland and Redman who pioneered in the field of polymeric bodies—the 'synthetic resins' which delight the eye and the senses with everything from nylon to nirvana.

And most of all, is it not the beneficiency of present day medicine, curative and preventive, of anaesthesia, and the miracles of modern surgery for which we are grateful? Let us not forget Pasteur and Lister, Koch and Ehrlich, nor the army of organized workers which to-day is intent on ridding us of our remaining scourges and adding to the span of life, and not for one generation alone is this creative work. While the physical structure of men are decaying, the facts he (the researcher) had learned are ever doing new service. Antitoxic devices will be increasing when locomotives are forgotten. Magnetic induction will work when the St. Lawrence river has ceased to flow.

"What shall we do, it has been asked, when there is no more research to apply? As great as is the need for continued effort in the application of existing knowledge, the old law of diminishing returns soon begins to take its toll unless new knowledge comes and removes the barrier to increasing returns. Our new *law of increasing returns* demands, if we would erect a superstructure of industrial and engineering application, that the foundation of progress, which is research in the realm of pure science, be strengthened and extended."

Industry was the first to apply the results of scientific research, but we as a nation will not reap the full benefits of research until our means to health, and our economic and social orders, also have received their full share of its benefits. As for economics and sociology, we are now doing as well as we know how. When the average man no longer pokes fun at fact-finding bodies—and no longer resents these when they are of government origin—we shall have taken a big step forward.

As for industry, our more progressive industries are endeavouring to maintain a consistent programme of research, but consistent sustained research has not yet acquired the status of an obligation of sound management in the minds of many of those in control of business finance. Too often research is looked upon as a luxury to be indulged during a period of large profits and to be discontinued or curtailed when dividends can no longer be fully maintained. Better to cancel fire insurance than to drop the only insurance against retrogression.

But we are awakening to the fact that the viewpoints and methods of research are applicable in ways we have been neglecting, and we begin to suspect that we shall continue such neglect at our peril. In our social institutions, in our government we are lagging behind. It would seem paramount to our general welfare that—without abating one whit our continuing support and development of scientific research—in other phases of our civilization, we proceed to catch up with material progress.

[1] The Romance of Research (Williams & Wilkins Co.)

POWER SUPPLY IN THE STEEP ROCK MINING AREA

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Paper presented before the Niagara Peninsula Branch of The Engineering Institute of Canada on November 16th, 1944

Histories of the development of Canada's mineral resources virtually all bear one striking similarity. In the discovery, exploration and early development of our major mining areas electric power has not usually played any major role, but the ultimate development of producing properties has invariably gone hand-in-hand with an adequate supply of low-cost hydro-electric power.

In this particular, the development of the Steep Rock Iron Mine has been no exception. As is described in companion papers, exploration work was carried out, up to the mapping-out of the ore bodies and the development of a scheme of exposing these deposits for open-pit mining by the diversion of the Seine River and the pumping out of Steep Rock Lake, with little assistance from the electric utility industry.

However, this scheme of development, which may be said to be the only practical scheme in the light of the experience gained in the exploratory work, demanded the supply of nearly 20,000 horsepower; first—to replace the capacity of the Moose Lake generating station of the Ontario-Minnesota Pulp and Paper Company, which was to be closed down by the diversion of the Seine River, and second—to supply power for the initial pumping operations and the later actual mining operations. The planning and construction of these power supply facilities has been the responsibility of the Hydro-Electric Power Commission of Ontario, acting for and on behalf of the Province of Ontario, under the province's scheme of Northern Ontario development.

Power is supplied from the Thunder Bay system of the Hydro-Electric Power Commission of Ontario, being generated in its Nipigon River plants, Cameron Falls and Alexander Landing, transmitted approximately 70 miles over three 110,000-volt circuits to the Port Arthur transformer station, from which point a new 110,000-volt, twin wood-pole line has been constructed, approximately 120 miles westerly to an interconnecting switching and metering station at the Moose Lake generating station. The resulting interconnected system arrangement is shown in outline in Fig. 1. It will be noted that there has been established a "back-bone" 110,000-volt transmission system extending from the Long Lac mining area on the east to Fort Frances on the west, a distance of nearly 400 miles, interconnecting hydro-electric generating resources totalling approximately 250,000 hp. These widespread facilities will unquestionably play a further part in the industrial future of the Lakehead district.

Commission's Thunder Bay System

The Thunder Bay system is the outgrowth of one of the earliest undertakings of the Commission following its formation in 1906. While actually commencing its operations in southern Ontario, the Commission very shortly thereafter entered the field of power supply in the lakehead district. Initially, power was purchased from the local private company, the Kaministiqua Power Company. In 1918, the Commission commenced the construction of its own power development at Cameron Falls, on the Nipigon river, some 70 miles east of Port Arthur, two 12,500-hp. units forming the initial installation.

Power was first supplied to Port Arthur over a single-circuit, 110,000-volt wishbone-type wood-pole line in December 1920. Power was received at the Bare Point transformer station, near the easterly limits of the city of Port Arthur, where one bank of three 5,000-kva. transformers was first installed.

From this beginning, the Cameron Falls generating station has been expanded to include six generating units, of a total capacity of 72,000 hp., and the 54,000-hp. Alexander development, first placed in service in 1930, has been added to increase the total system generating capacity to approximately 126,000 hp. Installation of a fourth generating unit is now in progress at Alexander, which, when available this year, will raise the total generating capacity to approximately 148,000 hp.

The original single-circuit wood-pole line to Port Arthur has been augmented by a double-circuit steel

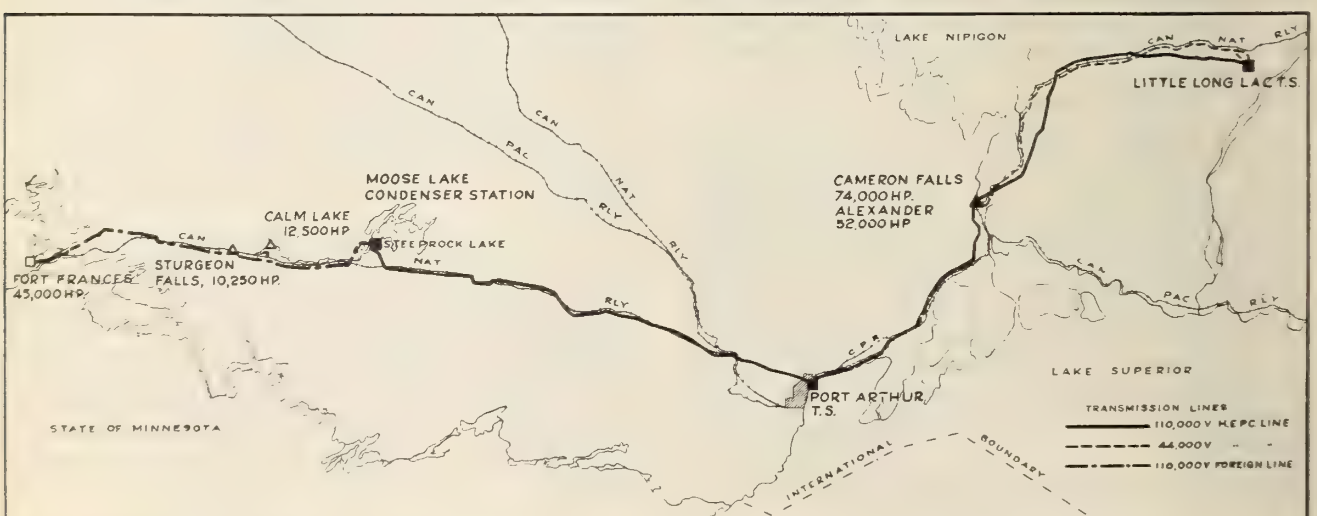


Fig. 1—Diagram showing power supply of Steep Rock area.

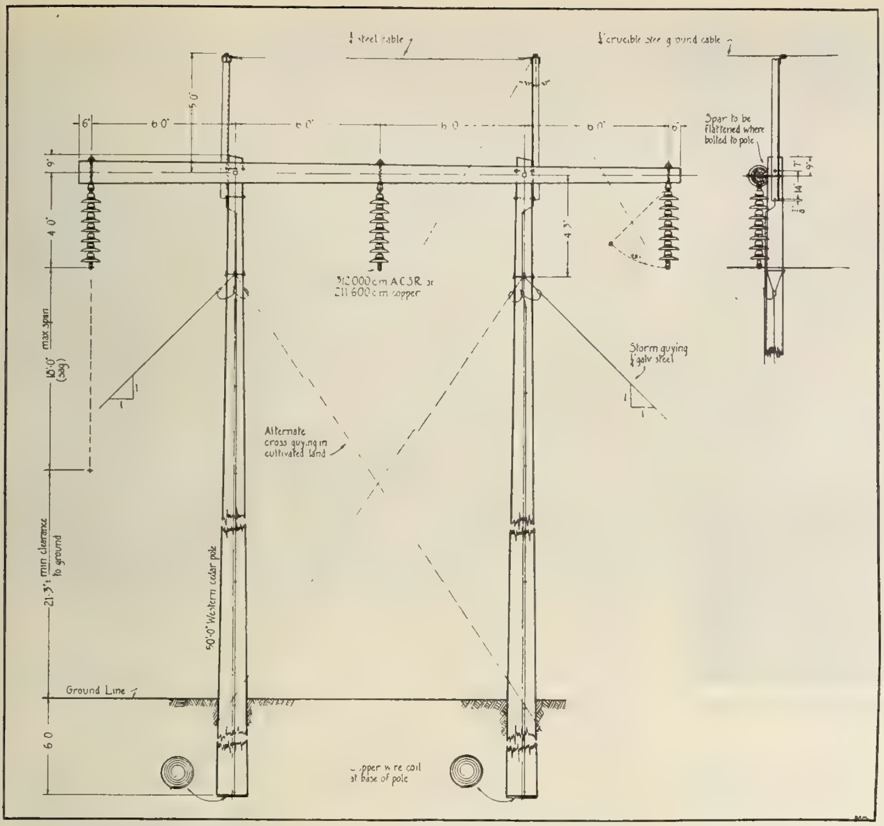


Fig. 2—Diagram illustrating the construction of the standard suspension structure.

tower line, so that three 110,000-volt circuits now extend from the generating stations to the receiving terminal at Port Arthur. In 1933, the system was extended to supply the gold mining areas which developed—first, in the vicinity of Beardmore, and then, in the Long Lac area. A 44,000-volt transmission line was originally constructed easterly from Cameron Falls to Long Lac, a distance of approximately 100 miles. This also was augmented in 1938, by the construction of a paralleling 110-kv. line and receiving transformer station.

The Port Arthur transformer station has been expanded to a capacity of 30,000 kva. and, in addition, a second transformer station provided at Fort William, of 18,000 kva. capacity. Furthermore, three large paper mill customers are supplied from the Port Arthur transformer station, directly at 110,000 volts.

The system peak load in December 1920 was approximately 10,000 hp. In November 1944, the system primary peak, including the power then being supplied under the Steep Rock contracts, reached 126,200 hp., a figure which compared to the normal system generating capacity of 126,000 hp. evidences the need for the fourth generating unit at Alexander. The average daily energy demand November 1944 approximated 2,000,000 kw. hours, representing a system daily load factor of virtually 90 per cent. The augmented controlled flow of the Nipigon river, created by the Ogoki diversion, is a major factor in supporting this unusually high average demand.

The New Steep Rock 110,000-volt Transmission Line

The new transmission line, constructed by the Commission to supply the power demands arising from the development of the Steep Rock property, is a single-circuit twin wood-pole line, extending from the 110,000-volt bus at the Port Arthur transformer station, approximately 120 miles westerly, to a new interconnecting and metering station at the Moose Lake generating station. Its construction was commenced in the spring of 1943 and it was completed and placed into service on November 28th 1943, approximately six months after the erection of the first pole. The construction was carried out almost entirely by the Commission's Construction Department, who have been complimented by outside observers for the efficiency and dispatch with which the work was carried through, particularly in the face of those difficulties incidental to wartime construction.

War conditions have introduced a number of interesting features into the line design. The normal construction favoured for such a line would include twin fir-plank arms for crossarm construction, with the twin poles extending approximately five feet beyond the point of crossarm support for the ground cable location. Fir plank arms are not available in wartime and a single pressure-treated pine pole arm therefore has been substituted. Suitable timber for the

Fig. 3—Typical suspension structure—Steep Rock Line.

Fig. 4—Typical semi anchor structure—Steep Rock Line.

main supports also becomes more difficult to obtain as its length increases and the average length of the poles therefore has been reduced, by utilizing steel bayonet extensions for the ground cable supports.

The construction of the standard suspension structure is illustrated in Fig. 2. Pole lengths average 50 ft. The twin-pole spacing and also the phase spacing is 12 ft. The ruling span is 500 ft., at which span the maximum sag of the power conductors is 15 ft. The ground cables are supported at a distance of nine feet above the power conductors, resulting in a lightning shield angle of 30 deg. Because of the importance of this circuit, and in an effort to secure good lightning performance, two ground cables have been provided throughout. These are interconnected and grounded at each structure. Radial crowfoot counterpoises will be provided later at points of high footing resistance.

For approximately 100 miles of the line length, the power conductors are 312,000 c.m. A.C.S.R. In the westerly 20 miles, 211,600 c.m. copper has been used. This conductor material was removed from line sections in the Niagara system, where the redistribution of power in the 110,000-volt transmission network has been so altered by increasing deliveries from the Eastern 220,000-volt system that the conductivity could be spared and the purchase of new conductor thus avoided. Ground cables are ¼ in., 160,000 lb. galvanized steel.

Insulators are standard, five-inch suspension units, seven in suspension and nine in strain positions.

Telephone communication is provided along the whole line route, though not, as is usual, on the power structures. The line parallels the Trans-Canada highway for approximately the first forty miles of its length and, in the majority of this section, the Commission has already rural service lines along the highway. In this distance, therefore, the telephone is largely on the rural power structures. From Shabaqua to near Atikokan, space has been leased on the telegraph structures of the Canadian National Telegraph Company on which the Commission's telephone is erected. From near Atikokan to the Moose Lake generating station the line is routed cross-country, paralleling the east arm of Steep Rock lake and, in this section, the telephone is on separate structures on the power line right-of-way.

The fact that the line has been constructed so close to the C.N.R. that it has been possible to utilize its structures for the support of the Commission's telephone circuit has created an interesting problem in co-ordination. The railway provides the only means of access to the line in approximately 75 miles of its length, for its initial construction and for its future operation and patrol. Obviously, also, for economic reasons, the shortest possible line was required, so that all factors tended to establish a line location close to the railway right-of-way. By agreement with the railway company, a minimum separation of line and track of 1,000 ft. was established, except in places where the presence of lakes or other topographical features made it impossible to maintain such separation.

With this specification established, the line was first located by the use of aerial photographs and then surveyed and staked by field survey parties. On the basis of the final location, detailed mathematical studies indicated the severity of induced fault voltages in the communication circuits and pointed to the degree of protection required. It is of interest that these studies were very closely checked by the result of field tests made before placing the line into service and the protection provided has performed satisfactorily for all system disturbances so far sustained.

The construction of the line is illustrated in Figs. 3, 4 and 5 being respectively, photographs of a typical suspension structure, one of the types of semi-strain, angle structures and a section of the line paralleling the Shebandowan Road.

System of the Ontario-Minnesota Pulp and Paper Company

The system of the Ontario-Minnesota Pulp and Paper Company consists of three hydroelectric generating stations on the Seine river, interconnected by, and delivering power into the company's paper mill at Fort Frances over a single-circuit 110,000-volt twin wood-pole line. The upriver plant is the Moose Lake station, consisting of two 6,000-kva., 6.6-kv., 60-cycle generating units. Downstream are the Calm Lake and Sturgeon Falls plants, consisting of two 5,500-kva. and two 4,500-kva. units respectively. The receiving station consists of one bank of three 10,000-kva. transformers, stepping down to a 6.6-kv. bus, to which is also connected the local generation at Fort Frances and which is extended across the river to the plant of the Minnesota-Ontario Paper Company at International Falls,

Fig. 5—General view of the new line paralleling the Shebandowan west of Shabaqua.

Fig. 6—The Moose Lake generating station.

where, in addition to local hydraulic generation, by-product steam-electric generators are also connected.

This system is operated almost entirely to supply the needs of the paper mills at Fort Frances and International Falls.

The normal controlled average flow of the Seine river is of the order of 1,200 cu. ft. per sec.; at times of above-average flow, the combined output of the three plants approximates 25,000 kw. As a result of the negotiations incidental to the Steep Rock development, it has been agreed that the long-time average capacity of the Moose Lake plant is 10,500 hp. at 85 per cent load factor and this is the amount of "replacement" power which is being delivered to the Ontario-Minnesota Company as compensation for the closing down of the plant. The Moose Lake generating station, seen from the tailrace, is illustrated in Fig. 6.

The Interconnected Systems

The major problem in interconnecting the Commission's Thunder Bay system and the Seine River system of the Ontario-Minnesota Pulp and Paper Company is that associated with voltage control. The new Steep Rock line interconnects the receiving end of the former with the transmitting end of the latter. At the Port Arthur transformer station the normal bus voltage approximates 115 kv., while at the Moose Lake generating station the normal voltage is 117 kv. Over the interconnecting 120-mile line, power must be transmitted in amounts up to approximately 20,000 hp. This problem, and the associated problems of stability, fault currents and relay protection, emergency and abnormal operating conditions were studied on the a.c. network analyzer.

Voltage regulation problems have been largely solved by converting the two generating units in the Moose Lake plant into synchronous condensers. The generator field poles have been replaced by new poles, in which starting windings are provided. An auto-transformer starting equipment has been installed, using a single magnetizing breaker and individual starting breakers. The transition from starting to running positions is completed by utilizing the Korndorfer principle.

The units thus converted have been found capable of delivering to the system approximately 4,500 lagging kvar. each, when operated over-excited as condensers. When operating under-excited, they will each draw approximately 3,500 lagging kvar. from the system, thus regulating the voltage at Moose Lake downwards during periods of light load or when paralleling the unloaded line from Port Arthur with the operating-system to Fort Frances. One calculation indicating the effectiveness of the synchronous condenser control is illustrated in Figs. 7 and 8. Figure 7 is a schematic representation of the interconnected systems and Fig. 8 is the result of an alternating-current analyzer study based on an emergency low transmitting voltage at Port Arthur transformer station of 112.5 kv. (The figures in circles are bus voltages in kv.; the open figures in the various line sections and at the loads are kw. and the bracketed figures lagging kvars, both flowing in the direction of the arrows.) Note the output of the Moose Lake condensers of approximately 8,000 kvars maintaining the required 6.6 kv. at Fort Frances and approximately 7.0 kv. at the supply to Steep Rock.

With this degree of voltage control it will be possible, if necessary, to deliver 30,000 to 35,000 hp. to the Steep Rock mining area. Thus the Moose Lake generating station, closed down as a generating station, is playing a major part in the delivery of power which replaces its capacity, all but its hydraulic turbines

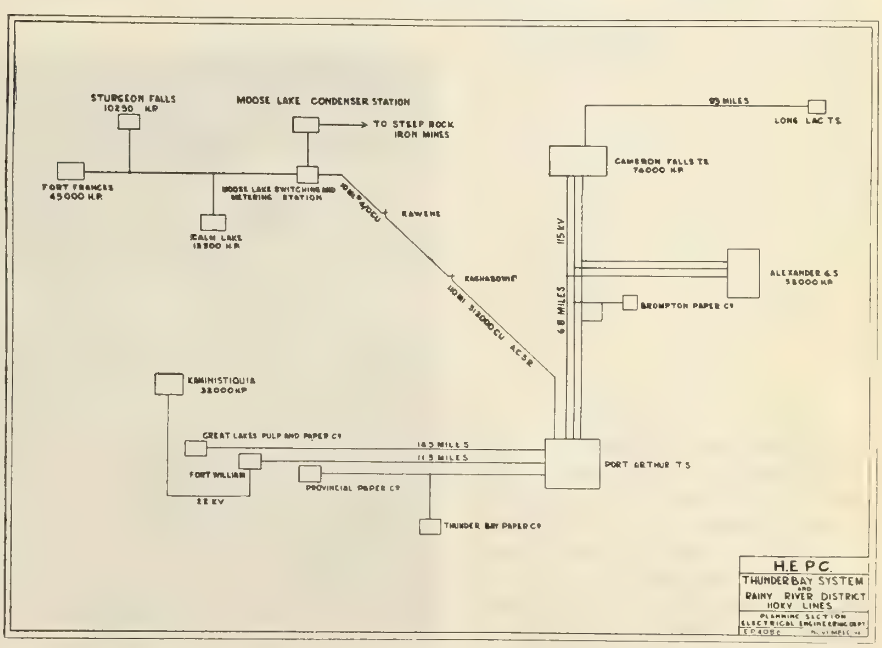


Fig. 7—Schematic diagram of the interconnected Thunder Bay and Seine River Systems.

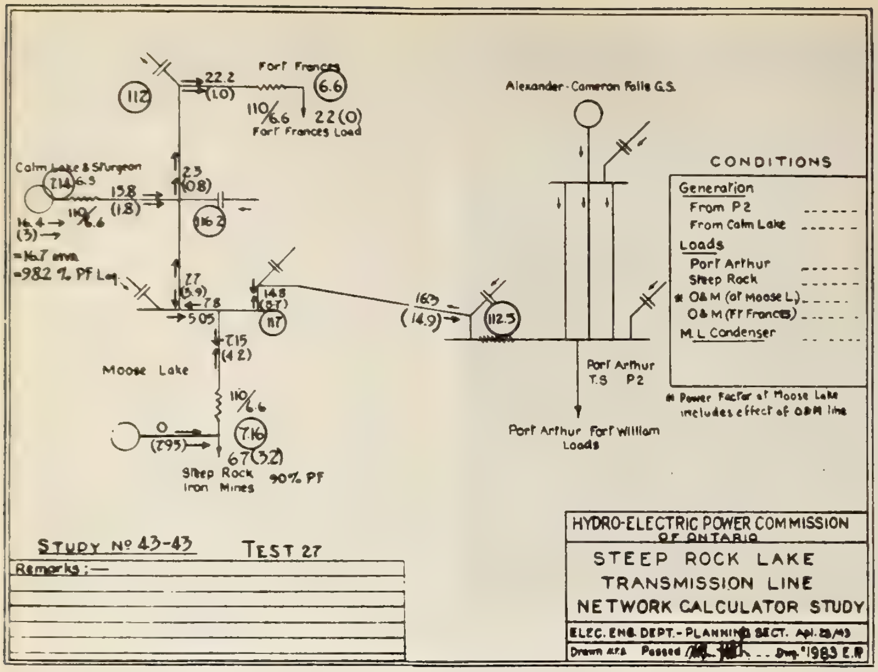


Fig. 8—Schematic diagram illustrating power flow conditions in the interconnected Thunder Bay and Seine River systems.

actually performing an essential service in the new system arrangement.

The high-voltage switching arrangement at Moose Lake is essentially an extension of the 110-kv. station bus, on which extension the new line from Port Arthur is terminated and to which the original line to Fort Frances has been transferred. The new line is terminated only through an air break switch, but a new oil circuit breaker has been installed in the Fort Frances line. Thus faults in the Port Arthur line must be cleared on the far side of Moose Lake, interrupting the Steep Rock load, so that this load is not left on the Ontario-Minnesota Company system. Conversely, faults in the Fort Frances line are cleared on the new breaker, so that supply to the Steep Rock area is not affected. The interconnecting switching and metering station is illustrated in Fig. 9.

Relay protection is essentially double-distance range relaying of the impedance type. Metering and synchronizing is by means of 110-kv. equipment inserted in the Fort Frances line at Moose Lake. Synchronizing facilities are also provided at the Port Arthur terminal. Later the Ontario-Minnesota Company proposes to extend the metering indications by telemetering from Moose Lake to their system operator at Fort Frances.

Supply to the Steep Rock Iron Mines

The existing equipment at the Moose Lake generating station has also been utilized to provide the means of supply to the Steep Rock mine. This supply is taken from the 6.6-kv. generator bus, transformed down through the main generating station transformers. Cable connections are run from this bus to a 6.6/44-kv., 8,000-kva. step-up station immediately adjacent to the Commission's high-voltage switching station. The step-up station consists of four 2,000-kva., 3-phase transformers, all connected solidly in parallel. Oil-circuit breaker protection is provided on the low-voltage side, fuse protection on the 44-kv. line side.

Power was transmitted originally only to a single receiving transformer station at the site of the pumping operation — over a six mile single-circuit wood-pole line circling the south side of the lake. At the pumping site the stepdown transformation consisted of four 2,000 kva, three-phase, 44,000/2,300 volt transformers, connected in parallel on the high side but through oil circuit breakers to a 2,300 volt distribution board supplying the seven pump barges and the mine feeder.

This equipment was so arranged that each transformer and its associated section of the distribution board formed a unit. With the decrease of power required for pumping and the establishment of demands for the crusher plant and at other load centres, certain of these transformer and switching units have been moved to other locations, short supply taps being taken from the original 44 kv. line as required.

A general view of the site of the pumping plant including the receiving transformer station, as it existed just prior to the commencement of pumping operations shown in Fig. 10. The four 2,000 kva transformers are seen in the foreground, the small building immediately behind housing the switching equipment. Individual 2,300 volt feeders were run to each barge, being supported on the structure projecting above the barge housing.

Pumping Equipment

The initial pumping station was located at the narrows between the main body and the westerly arm

Fig. 9—The interconnecting switching and metering station.

Fig. 10—Incomplete pumping station at the Narrows, Steep Rock Lake, November, 1943.

barges complete with their starting and control equipment. The piping connections were such that these pumps could be operated singly until the lake level had been reduced some 100 ft., after which they would be connected in series for pumping against the higher head.

The pumping plant was placed in operation early in December 1943 and, until the early spring of 1944, pumped an average of approximately 480,000,000 gals. per minute. By the early summer the site of the "B" ore body was uncovered, since which time the unwatering operations have continued as the conditions disclosed by the receding water levels have dictated.

of Steep Rock lake, immediately upstream from the two rock-filled dams which close off the lake at this point. A 10 by 12 ft. tunnel, 400 ft. long was driven through the island which lies in the narrows and, on the upstream side of this tunnel, a forebay formed from the rock spoil, into which the pumps discharged.

A total of fourteen centrifugal pumps was provided for the main pumping operation, each rated at 24,000 gals. per min. at 50 ft. head, 18,000 gals. per min. at 100 ft. head. This is approximately equivalent to 750 cu. ft. per sec. at the low-head or 550 cu. ft. per sec. at the high-head, the former figure being approximately 60 per cent of the normal controlled average flow of the Seine river.

Twelve of these pumps were driven by 500 hp., 2,300-volt induction motors; two by 500-hp. synchronous motors. The pumps were mounted in pairs on steel-plate

Conclusion

The winter of 1944-45 finds the Steep Rock property standing on the threshold of commercial operation. All told nearly $18,000,000 will have been spent, including the cost of power supply and the means of delivering ore into lake bottoms at Port Arthur, to bring the property to this state. In the future, the visionary can foresee the Steep Rock ore and low cost hydro-electric power available in this district combining to create in Canada an entirely new industrial development. Whether such will come to pass, time alone will tell, but time will not rob the story of Steep Rock of any of its romance nor the engineers who have brought it to its present stage of development of any of the satisfaction derived from a job well-done.

Acknowledgment

The author wishes to acknowledge the kindness of Steep Rock Iron Mines Limited in permitting the presentation of the data concerning its operations.

ANNUAL FEES

Members are reminded that a reduction of one dollar is allowed on their annual fees if paid before March 31st of the current year. The date of mailing, as shown by the postmark on the envelope, is taken as the date of payment. This gives equal opportunity to all members wherever they are residing.

THE IMPORTANCE OF DESIGN IN A TAX STRUCTURE

STUART S. GARSON, K.C.
Premier of the Province of Manitoba

An address delivered at the Fifty-Ninth Annual Dinner of The Engineering Institute of Canada, at Winnipeg, Man., on February 8th, 1945

When I think of the frustration which engineers, whose emoluments as a profession are closely bound up with the working-out of our national policy, have suffered at the hands of politicians, my wonder is that you should admit me to your gathering at all. That you have actually consented to permit me as a politician to discuss these frustrations with you, is a piece of magnanimity upon your part, and for me a great and most unexpected honour.

The activities of your profession arise in large measure out of the investment of savings in enterprises which require for their creation engineering services. The decisions to invest are made on the basis of profits presently available, plus the prospect of future profits. Therefore, to an even greater extent, perhaps, than most other professions, you are interested in present prosperity, in the prospects of future prosperity, and in those public policies which will create and stabilize a condition of prosperity. To this end, few factors are more important to-day than taxation policy. There has been a very great change in this regard since 1867 when the British North America Act brought the Dominion of Canada into being.

Evolution of Taxation Policies in Canada

The British North America Act, 1867, was conceived in the political philosophy of laissez faire, that the less the government interfered in the business and industry, the better for the nation. The responsibilities of all governments were restricted by this philosophy. Consequently, prior to the turn of the century, the governments of Canada collected and spent a relatively small part of the national income. Under such conditions, a simple rule-of-thumb system of taxation was adequate for public needs, and created no serious inequities.

As conditions and our Canadian political ideas changed, however, the demands upon governments grew, and later multiplied. As more and more of the national income came to be raised and spent by the governments of Canada, it became necessary to develop a taxation system more exactly adjusted to ability to pay. It became even more necessary, and in recent years increasingly necessary, to consider the effects of tax policies upon the general prosperity of the nation. With the steady increase in the proportion of the national income which is collected by taxation and spent by governments in public services, there is an equally steady increase in the probability that unwise taxes will depress that income, whereas wise taxation and wise public expenditures may substantially increase it. Therefore, as compared with say 60 years ago, tax problems to-day are so different in degree as to be different in kind. Tax policies which were adequate 60 years ago or more, to-day would be disastrous. As the health of the Canadian economy comes to depend more and more upon public policy, we need efficiency in taxation more and more, and efficiency in taxation becomes more and more difficult to achieve.

Efficiency in taxation has been defined as "skill in collecting a given amount of revenue with the least possible burden upon the national income." When, under modern conditions, efficiency in taxation is so essential and so difficult to attain, we are most unwise to tolerate legal impediments and habits of thought, which prevent us from achieving efficiency in taxation. Yet that is what we have been doing in Canada for decades. Let me explain briefly why this is so.

Generally speaking, the national income will be restricted if revenues are raised from taxes which increase the cost of production and of doing business. Most indirect taxes, like the sales tax for example, do this, for they raise the price of materials and supplies and increase costs all along the line. Obviously it is undesirable that taxation should eliminate either a firm or an industry, by destroying the margin of profit which keeps it going. That is what taxes which increase the costs of production tend to do. As such taxes are imposed, marginal firms which are just barely making ends meet, tend to disappear. When by the collection of what is relatively a small sum in taxes, a marginal firm is thrown out of production, the consequent loss of production or employment may be out of all proportion to the amount of public revenue which is involved. At the same time potential investors in new enterprises will be deterred from entering into industries in which costs have been raised by taxation, and consumption has been restricted by high prices due to taxation. When marginal firms disappear, and when potential investors are deterred from starting new enterprises, labour, capital and resources are all left unemployed or are thrown out of employment. The result is that the national income is correspondingly reduced, and incidentally, the engineering profession loses retainers which it might otherwise have had. Out of this diminished national income, larger tax revenues than before will have to be raised in order to meet the cost of maintaining the unemployed. If in raising these new revenues, the forms of taxes which are imposed are again levied upon costs, the vicious circle will be completed and a new vicious circle begun.

The alternative to taxes which increase business costs are taxes which fall upon net incomes and other surpluses. It is impossible to exaggerate the importance of reforms which would replace taxes upon costs, by taxes on surpluses. For it is largely by the avoidance of burdens upon marginal enterprises that a more sustained and stabilized employment of the nation's manpower and capital and natural resources can be achieved.

Yet with these principles plainly before us, Canada has continued to raise, from taxes which increase costs, a larger part of the total revenues of its government than are raised in other comparable countries from such taxes. As a result Canada has had before the present war began, one of the worst and most regressive tax structures in the world. Consider it as it stood in 1930, taking into account then all taxes in Canada, federal, provincial and municipal. 35 per cent came from customs duties, excise taxes, amusement taxes, public domain and miscellaneous taxes. Slightly over 25 per cent came from corporation taxes, gas taxes and sales taxes, etc. 33 per cent came from real estate, and we wondered why building languished. What percentage do you suppose came from taxes upon profits and surpluses, i.e. progressive taxes upon personal incomes and inheritances? Only 7 per cent. This 1930 tax structure was exceedingly ill-balanced, but during the depression it was not corrected—it was aggravated. Almost three-fourths of the increases in federal taxes between 1930 and 1937 were produced by the sales tax—a tax which increased business costs. As a consequence, recovery from the depression was retarded by business-destroying consumption taxes, by employment-destroying real estate taxes and by economically harmful taxes upon corporations and business generally.

Allocation of Taxing Powers

This lamentable state of affairs was not the result of the ignorance or perversity of politicians, nor of a mistaken policy which can be changed by them at will. It is the practically inevitable consequence of the present allocation of governmental responsibilities and taxing powers as between the Dominion and the provinces.

This allocation has remained unchanged since the sailingship days of 1867, when the Dominion of Canada was first created by the British North America Act. This Act and its amendments are our Canadian constitution. By it the functions of government were divided between the Dominion government upon the one hand, and the provinces upon the other. To the provinces were assigned the local functions of government, such as social services, the building of roads, provincial public works, education and municipalities. At that time these provincial functions could be discharged very cheaply. The provinces, therefore, were given the strictly limited taxing powers of direct taxation. At that time direct taxation was not used. It was too unpopular. It could not be concealed in the cost of living but was out in the open where it made the taxpayer conscious of its pressure upon him. Thus the idea was if the provinces were tempted to do their inexpensive work in an extravagant manner, the fact that such extravagance would involve them in the imposition of unpopular direct taxes would cause them to be prudent and thrifty.

To the Dominion were allocated the expensive national functions of government, such as the regulation of trade and commerce, banks and banking, customs tariffs, railways and canals, our money system and all matters of defence, including the pensions payable to the armed forces. The Dominion, having far more expensive functions of government to pay for, was given the right to impose any kind of tax, direct or indirect.

In law, provincial taxing powers were limited, Dominion taxing powers unlimited. In practice, Dominion taxing powers were limited in fact because the provincial powers were limited in law. This curious result arose from the Dominion's recognition that it should not invade the province's one field of taxation if it could avoid doing so.

Thus it was not until 50 years after Confederation, and three years after the beginning of the first world war that the Dominion, under the pressure of war needs, first invaded the provincial field of direct taxation with its War Income Tax measure of 1917. In spite of the moderation of his Federal tax levy, Sir Thomas White, in introducing it in the House of Commons, apologized for his action, saying : "The provinces and municipalities are confined to direct taxation, and I have not regarded it as expedient, except in cases of manifest public necessity, such as I believe exists at the present time, that the Dominion should invade the field to which the provinces are solely confined for the raising of their revenue."

The Dominion had completely refrained from invading the provincial field from 1867 to 1917. The taxes which it then imposed in this field were commenced and have continued from that time until the beginning of the present war on a basis so moderate as not to embarrass the provinces in securing their own revenue needs from the field of direct taxation.

Efficiency in Taxation Difficult under Present Constitution

Now the difficulty is that this field of taxation to which the provinces are solely confined, namely the direct taxation of net incomes and surpluses, is the very field from which under modern conditions in a federal state such as Canada, the federal government should derive most of its revenues. The indirect taxes upon which the Dominion government has been relying to an inordinate extent in the past are those which are levied upon goods and services and transactions. Indirect taxes are passed on by those who pay them in the first instance, and thus finally come to rest upon, and are indirectly paid by, the consumer. Indirect taxes, therefore, generally speaking, are those which lead to an increase in the costs of production and of doing business. Direct taxes, generally speaking, are those which fall upon profits and other surpluses and on incomes in accordance with ability to pay.

It was largely because before the war the Dominion Government, instead of getting the bulk of its revenues from direct taxation upon net income and other surpluses, had been getting most of its revenues from indirect taxation which adds to the cost of production and of doing business, that our pre-war tax structure has been such an exceedingly ill-balanced one. There is no shadow of doubt that this tax structure greatly retarded our recovery during the depression. Moreover, the situation is becoming more and more aggravated with the passage of time. Both the functions of government and the costs of discharging them are increasing. For example the cost of discharging certain provincial functions of government, such as social services, road building, public works, education, have increased enormously since 1900, and will continue to increase. To meet these increased costs, the provinces have had to impose heavier and heavier direct taxes. The taxable resources of the various provinces vary greatly. Because some provinces are much less well-to-do than others, they must impose much higher provincial tax rates, in order to support provincial services which even approach equality with those of the richer provinces.

The Dominion as we have noted, although it has always had the power to impose direct taxation, could do so only by invading the one field which the provinces enjoy. Even when the Dominion does this, it finds it difficult to impose federal rates which will fit equitably into the widely varying tax rates of the different provinces. Thus the Dominion's invasion of the provincial field of taxation has widely different results in the different provinces, depending upon the level of the provincial rates of taxation in the same field. The difficulty of this problem and the importance of solving it will increase as the percentage of the national income which all governments of Canada spend increases. Just before the war our governmental expenditures in Canada were equal to about 30 per cent of the national income. As you know they had been growing steadily with the years. That growth has been greatly accelerated by the war. And while this war growth is of course temporary, there is not the slightest doubt that postwar governmental expenditures at all levels will absorb a considerably larger part of the national income than did the expenditures of governments in Canada before this war.

"But," you may say, "surely postwar expenditures in Canada will not be as great as the war expenditures have been, and why is it that in spite of this unsolved tax problem, it has been possible for Canada to achieve the gigantic production records which she has made during the war?" The answer is that we solved this tax problem during the war. If we had not done so these production records would never have been made, and indeed the war effort itself would have been endangered.

How did we solve it? One of the recommendations of the Rowell-Sirois Commission was that the provinces should transfer to the Dominion the exclusive control over direct taxes upon personal and corporation incomes and inheritances, that is to say, direct taxes upon net income and surpluses. When the war came it was manifestly impossible for the Dominion Government to meet the unprecedented financial burdens of the present war out of federal indirect taxation, which would tend to increase the cost of production and of doing business, and thereby wreck our price ceiling and wage control policies, and gravely endanger the war effort. Therefore, in the early stages of this war, the Dominion entered into an agreement with the provinces under which they surrendered to the Dominion for the duration of the war and one year thereafter, the exclusive right of imposing direct taxes upon the incomes of individuals and corporations. For this surrender, the Dominion pays to the provinces the amount which they collected from these sources in the last full year before the agreement was made. In other words, what was achieved by this agreement was the temporary implementation of the most important recommendation of the Rowell-Sirois Commission.

Reform Essential to Post-War Prosperity

Now I suggest that if we do not retain in effect the substance of this Dominion-Provincial taxation agreement after the war, either by extending it in some suitable form or by providing an adequate substitute, we have no more hope without it of achieving full employment in the post-war period than we had of having a successful war effort without such an agreement. I suggest that just as it was impossible to finance this war by federal indirect taxation which increased the cost of production and of doing business, it will be impossible for the Dominion to finance by indirect taxation its expenditures after the war upon greatly increased social services, such as family allowances and old age pensions, upon demobilization and pensions, upon carrying charges upon the war debt, upon floor prices for agricultural products, and upon the discharges of a substantial and continuing defence responsibility on land, on sea and in the air. These things have to be paid for, if not by indirect taxation upon the costs of production and doing business, then by direct taxation upon net incomes and surpluses.

The experience of the depression is excellent proof, if any were needed, that it is utter folly to expect to finance the Dominion's postwar responsibilities out of indirect taxes. Our experience of this war corroborates the experience of the depression by showing what can be done with a properly designed tax structure built around federal direct taxes upon net income and surpluses.

Let me emphasize here that I am not suggesting for a moment that after the war all indirect taxes should be abolished and that the present war income taxes should be increased. I think we can and should reduce our total income tax collections from corporations and individuals by a considerable margin. But we would be making a most grievous error if we attempted again to obtain from indirect taxes which increase costs of production and business the percentage of the national revenue that we consistently obtained from this source before the war.

If after the war we get what we should get from direct taxation the Dominion will have to maintain at a level lower than our present war taxes, but substantially higher than its pre-war level, the federal taxes upon incomes and inheritances. True, there may be some shifts to encourage the investment of risk capital, and that sort of thing. But in the aggregate the amount of revenue which must be obtained from this source of direct taxation will be much greater than what the Dominion has ever collected in pre-war times. There is, therefore, no longer any possibility of the Dominion Government keeping down to low levels, as it did in the period between 1867 and 1939, its federal direct taxation, in order that the provinces may have this field largely to themselves.

Hence when the present Dominion-Provincial taxation agreement expires, the provinces will get back—what? They will get back their constitutional right to impose provincial direct taxation. But what good will this right be to the provinces if they have to re-impose their provincial rates of direct taxation on top of federal direct taxes which are themselves at high levels?

Let us remember that the provinces will need not the same revenues as before, but presumably more. To provide work for the very large number of men and women who will return to civilian employment from military service and war industries, Canada must have and must implement a national postwar programme. Large parts of this programme, will be the sole responsibility of the provinces. For example, the larger part of the field of social services, the whole of the costly field of education, and the bulk of governmental public works, owing to the fact that the natural resources of the country belong to the provinces, are all responsibilities of the provinces, not of the Dominion. Even when the provinces had their field of direct taxation largely intact, it was insufficient for their purposes before the war. How can it be supposed that it will be sufficient for provincial purposes after the war, at a time when the Dominion has invaded the sole field of provincial taxation on a large scale?

Thus it is clear that, in some of the most vital and critical parts of our postwar activity, some of the provinces—probably a majority of them—will have the constitutional right to do things, but not the ability to pay for them, while the Dominion will be able to pay for them but will not have the constitutional right to do them. Those portions of this programme which are the provinces' responsibility and which they cannot pay for, the Dominion will not have the right to do; and the programme to that extent will simply fail of accomplishment. If the provinces are going to discharge these heavy postwar responsibilities they will need substantial revenues. If they have to secure these additional revenues by re-imposing their provincial rates of direct taxation, on top of high federal direct taxes, many of them, including Manitoba, will be placed in an impossible position. Before the war, ours were amongst the highest provincial rates of income and corporation taxes in Canada. To increase these rates and to superimpose them on top of high federal direct taxes is wholly unrealistic and out of the question.

Yet, except that postwar conditions will make it more critical than ever, there is nothing new in this tax situation. For a quarter of a century at the very least, the dilemma of the Dominion Minister of Finance has been to choose between two bad alternatives. If he got his federal revenue from progressive direct taxation upon net incomes and surpluses, he had to invade the province's only field of taxation and run the risk of seriously impairing the finances of the more vulnerable provinces. If on the other hand he adopted the alternative course, he had to rely upon indirect taxes which increased the cost of production and of doing business throughout the country, and upon a policy, therefore, which was economically harmful to employment and to the national income.

As long as the provinces retain the field of direct taxation, given to them by the British North America Act, the Dominion Minister of Finance will be faced with the choice of either having a thoroughly unsound tax structure which will depress the national income and create unemployment, or of bankrupting some of the provinces.

As a result of this tax problem and other maladjustments in Dominion-provincial relations, Canada in 1937 had a crisis in public finance which resulted in the default of one province and the saving from default of others by interim federal grants, and the appointment of the Rowell-Sirois Commission. The responsibilities and expenditures of both federal and provincial governments were less in those days than they will be from this time on. It seems certain that the provincial needs which gave rise to the appointment of the Rowell-Sirois Commission will be substantially increased in the near future. These increased needs make imperative as an indispensable foundation for Canada's economy in the postwar, the reform of our Dominion-provincial relations. No part of our Dominion-provincial relations is in greater need of reform than the present allocation of taxing powers. Under the best of circumstances our Canadian tax structure is going to have a very heavy load to carry from this time on. Our pre-war tax structure was so poorly designed that it collapsed under a lesser load. One of the first tasks of a Dominion-provincial conference is to re-design our national tax structure in such a way as to make it capable of carrying the load which will inevitably be placed upon it.

Engineers are Directly Concerned

If we fail in this task, the consequences will fall with greater or lesser severity upon every single Canadian, and upon no group more severely than upon the engineering profession. It is for this reason, and because you are such an important and powerful segment of public opinion in Canada that I entreat you to lend the great weight of your influence to the creation of a public opinion across this country which will make it impossible for any of its public men to oppose successfully this simple, basic and indispensable reform, of having the provinces turn over to the Dominion the exclusive right of imposing direct taxation upon net income and surpluses.

For the surrender of this exclusive right the provinces should receive from the Dominion compensatory payments which will enable them to provide for Canadians everywhere in Canada, average social, educational and governmental services without having to impose provincial taxation in excess of the Canadian average. This can be done in a manner which I have not the time to discuss in detail here, but which would preserve the financial responsibility of the provincial treasury. In this way each province in Canada would have its provincial autonomy intact. And it would be a real autonomy of legal powers plus financial capacity, instead of the illusory autonomy of legal powers minus financial capacity. The greatest advantage of such an arrangement, however, would be that it would provide a sound hope for avoiding large scale unemployment after the war. If we restore our pre-war tax structure in this country we shall not be able to indulge ourselves in such a hope.

CORDUROY ROAD IN HOLLAND

Canadian engineers, aided by Dutch civilians, spread stone on a damaged road bed—Part of reconstructional road work made necessary by heavy traffic preceding the renewed Allied offensive on the Western front.

(***Canadian Army Overseas Photo.***)

TURNING IN A WIND

BERNARD ETKIN, Jr.E.I.C.

Lecturer, Faculty of Applied Science and Engineering, University of Toronto

SUMMARY—An analysis of the problem of an airplane turning in a wind is presented. The change in the kinetic energy of the machine referred to earth axes is shown to be caused by work done on the aircraft by the air. The change in groundspeed is computed from a consideration of the same force which does the work.

Work Done in Earth System

The change in kinetic energy of an aircraft turning in a wind has been the object of considerable discussion, particularly among pilots. The cause of a certain type of accident is sometimes erroneously ascribed to this source.[1]

When turning in a wind at a constant airspeed, the kinetic energy of an airplane, measured relative to axes moving with the air (subsequently called "moving axes"), remains constant. When the motion is referred to axes fixed on the earth (subsequently called "earth axes") however, the machine has more energy when flying downwind than it has flying upwind. The difference is

$$\triangle E = \tfrac{1}{2}m\left[(V+v)^2 - (V-v)^2\right] = 2mVv$$

where m = mass of airplane,
V = airspeed,
v = wind speed.

The resultant of all the forces acting on an airplane making a level turn at constant airspeed is the centripetal force—a component of the lift directed inwards. Considering first the motion relative to the moving axes, we obtain that the force is

$$C = \frac{mV^2}{r}$$

where r = instantaneous radius of turn.

This force is normal to the path and does no work in the moving system. In the system referred to earth axes, however, we observe that the force is not at right angles to the path and consequently does work. We proceed to compute the work done when the airplane turns 180 deg. from flying upwind. From the diagram we see that the rate of work is

$$\frac{dW}{dt} = \frac{mV^2}{r} V_1 \cos\phi$$

but $$V_1 \cos\phi = V_1 \sin\alpha = v\cos\theta$$

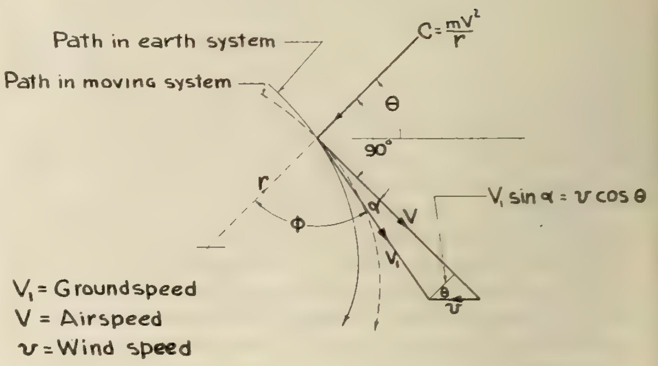
whence $$\frac{dW}{dt} = \frac{mV^2}{r} v\cos\theta$$

The angular velocity in the turn is

$$-\frac{d\theta}{dt} = \frac{V}{r}$$

hence $$\frac{dW}{dt} = -mVv\cos\theta\frac{d\theta}{dt}$$

[1] Upwind versus Downwind Turns—Richard R. Bloss, *Aero-Digest*, Jan. 1941, p. 155.



and $$W = -\int_{\theta=\pi/2}^{-\pi/2} mVv\cos\theta\, d\theta = 2mVv$$

The gain in kinetic energy is thus seen to be the same as the work done on the airplane by the air.

Change in Groundspeed

It is interesting to note that the change in groundspeed can also be calculated. The component of C acting in the direction of V_1 is

$$F = \frac{mV^2}{r}\cos\phi$$

and the linear acceleration is

$$a = \frac{V^2}{r}\cos\phi = -\frac{d\theta}{dt}V\cos\phi$$

The total change in V_1 is

$$\triangle V_1 = \int a\,dt = -V\int_{\theta=\pi/2}^{-\pi/2}\cos\phi\, d\theta$$

but $$\cos\phi = \frac{v}{V_1}\cos\theta$$

and from the diagram

$$V_1 = \sqrt{V^2 + v^2 - 2Vv\cos(\pi/2 - \theta)}$$
$$= \sqrt{V^2 + v^2 - 2Vv\sin\theta}$$

Hence

$$\triangle V_1 = -Vv\int_{\pi/2}^{-\pi/2}\frac{\cos\theta\, d\theta}{(V^2 + v^2 - 2Vv\sin\theta)^{\frac{1}{2}}}$$

$$= -Vv\left[-\frac{1}{Vv}(V^2 + v^2 - 2Vv\sin\theta)^{\frac{1}{2}}\right]_{\pi/2}^{-\pi/2}$$

$$= (V+v) - (V-v)$$
$$= 2v$$

THE FIFTY-NINTH ANNUAL GENERAL MEETING

Convened at Headquarters, Montreal, on January 25th, 1945, and adjourned to the Royal Alexandra Hotel, Winnipeg, on Wednesday, February 7th, 1945

The Fifty-Ninth Annual General Meeting of The Engineering Institute of Canada was convened at Headquarters on Thursday, January 25th, 1945, at eight o'clock p.m., with President deGaspé Beaubien in the chair.

The general secretary having read the notice convening the meeting, the minutes of the Fifty-Eighth Annual General Meeting were submitted, and, on the motion of A. S. Rutherford, seconded by T. C. Price, were taken as read and confirmed.

Appointment of Scrutineers

On the motion of Huet Massue, seconded by E. R. Smallhorn, Messrs. J. A. Lalonde, A. D. Ross, 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. R. Banks, seconded by E. Nenniger, that the meeting do adjourn to reconvene at the Royal Alexandra Hotel, Winnipeg, at nine-thirty a.m., on the seventh day of February, nineteen hundred and forty-five.

Adjourned General Meeting at The Royal Alexandra Hotel, Winnipeg, Manitoba

The adjourned meeting convened at nine thirty a.m., on Wednesday, February 7th, 1945, with President deGaspé Beaubien in the chair.

In welcoming the members, and in thanking them for coming such long distances to attend the meeting, Mr. Beaubien remarked that for a long time the Institute has discussed the possibility of holding an annual meeting in the west, but had been somewhat reluctant to do so because of the distance from the larger centres. The large attendance and great success of this meeting indicated that it could be done, and he expressed the hope that there would be many opportunities of returning to Winnipeg or other western cities.

Nominating Committee—1945

The general secretary announced the membership of the Nominating Committee of the Institute for the year 1945 as follows:

Chairman: R. L. Dunsmore

Branch	*Representative*
Border Cities	C. G. R. Armstrong
Calgary	F. K. Beach
Cape Breton	M. R. Chappell
Edmonton	E. Nelson
Halifax	C. Scrymgeour
Hamilton	W. J. W. Reid
Kingston	D. C. Macpherson
Lakehead	H. G. O'Leary
Lethbridge	H. T. Miard
London	T. L. McManamna
Moncton	A. Gordon
Montreal	L. H. Burpee
Niagara Peninsula	J. H. Ings
Ottawa	L. M. Christmas
Peterborough	W. T. Fanjoy
Quebec	J. O. Martineau
Saguenay	N. F. McCaghey
Saint John	A. R. Crookshank
Saskatchewan	A. P. Linton
Sault Ste. Marie	R. A. Campbell
St. Maurice Valley	M. Eaton
Toronto	N. MacNicol
Vancouver	T. V. Berry
Victoria	S. H. Frame
Winnipeg	J. T. Dyment

Award of Medals and Prizes

The general secretary announced the awards of the various medals and prizes of the Institute as follows, stating that the formal presentation of these distinctions would be made at the annual dinner of the Institute the following evening:

Gzowski Medal—To W. Griesbach, M.E.I.C., Montreal, for his paper "Construction of Shipshaw Power Development".

Leonard Medal—To J. E. Gill, C.I.M.M., Montreal, and P. E. Auger, C.I.M.M., Quebec, for their joint paper "Zinc Deposits of the Federal Area".

Plummer Medal—To Dr. Wilfred Gallay, Ottawa, for his paper, "Plastics in Engineering".

Keefer Medal—To M. V. Sauer, M.E.I.C., Montreal, for his paper, "St. Lawrence River Control and Remedial Dams—Soulanges Section".

Ross Medal—To R. A. H. Hayes, M.E.I.C., Montreal, for his paper, "Electrical Equipment at Shipshaw".

Canadian Lumbermen's Association Prize of $100.00—To C. F. Morrison, M.E.I.C., Toronto, for his paper "Modern Timber Engineering".

Julian C. Smith Medals—"For Achievement in the Development of Canada"—To Dean E. P. Fetherstonhaugh, M.E.I.C., Univ. of Manitoba, Winnipeg, and John A. Wilson, M.E.I.C., Director of Air Services, Department of Transport, Ottawa.

Students' and Juniors' Prizes

(Books or Instruments to the value of $25.00)

John Galbraith Prize—(Province of Ontario)—To A. Hershfield, S.E.I.C., for his paper "Plywood—A Structural Material for Aircraft".

Ernest Marceau Prize—(Province of Quebec—French)—To Andrè Leclerc, S.E.I.C., for his paper "Influence de la Vitesse d'essai sur la rèsistance".

Martin Murphy Prize—(Maritime Provinces)—To J. L. Belyea, S.E.I.C., for his paper "The Cathode Ray Oscillograph and its application in Industry".

Report of Council, Report of Finance Committee, Financial Statement and the Treasurer's Report

On the motion of F. C. Mechin, seconded by C. H. Fox, 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. Chandler, seconded by S. H. deJong, it was resolved that the reports of the following committees be taken as read and accepted: Publication, Legislation, Employment Service, Library and House, Board of Examiners and Education, Industrial Relations, Prairie Water Problems, Engineer in the Civil Service, the Young Engineer, Employment Conditions, Engineer in the Active Services, Engineering Features of Civil Defence, Professional Interests, Papers and the Deterioration of Concrete Structures.

Branch Reports

On the motion of G. H. Burbidge, seconded by J. H. Johnson, it was resolved that the reports of the various branches be taken as read and approved.

Community Planning

The president announced that at the annual meeting of Council held on the previous day, considerable discussion had taken place on community planning, as a result of which it had been decided to present a resolution to the annual meeting.

In presenting the following resolution Mr. McLeod reminded the meeting that there had been in Canada a Town Planning Institute which, in recent years, had been quite inactive. Council felt that community planning should be revived but not on a purely professional basis, and that the Institute should support the movement in every way possible. He therefore had much pleasure in moving the following resolution:

> THAT this session of the annual meeting of The Engineering Institute of Canada held in Winnipeg on February 7th, 1945, wishes to place itself on record as acknowledging the responsibility of the profession and the Institute in the vital subject of community planning. It recommends that the Council of the Institute establish immediately a committee to develop and administer a programme of activities whereby the Institute may make the maximum contribution to the solution of the many problems present in all parts of Canada. This programme should include encouragement and support of a planning Institute at the national level, development of interest in local problems by each branch, and publicity on a local and national basis that will inform the public as to what is in its best interest, and of the engineer's concern for its welfare.

This was seconded by P. E. Doncaster, and carried unanimously.

Increase in Fees

C. K. McLeod, as chairman of the Finance Committee, informed the meeting that for some time the Finance Committee had been considering the advisability and the possibility of increasing Institute fees. The matter had been brought to Council several times by the Finance Committee and he believed that Council would favour a reasonable proposal. He stated that in comparison with other societies of a similar type, the Institute's fees were ridiculously low. He had examined some statistics with regard to similar organizations in the United States and he found that on a membership basis the Institute's staff should be more than twice as large as it is now, but he pointed out that the American societies' fees were substantially higher than those of the Institute.

He was of the opinion that there were many duties ahead for the Institute and that these could not be undertaken on the present volume of income. He did not think that the Institute's activities should be retarded or that future opportunities should be neglected because of lack of funds.

Mr. McLeod then referred to the decision of Council to employ someone for the principal task of rehabilitation of members in the Armed Services and in wartime industry. He thought this was a very important work and was definitely an obligation of the Institute. He referred to the voluntary assessment that had been recommended by Council for 1945, and informed the meeting that the returns so far were excellent.

He also pointed out the great increase in the number of Students and Juniors in the Institute and recommended that the Institute should undertake additional services to this group. To do such a job properly a fair amount of money would need to be expended that could be derived only from an increase in fees.

The general secretary referred to the voluntary assessment returns which have been mentioned by Mr. McLeod and stated that so far less than one per cent of the members who had paid their fees had struck out the item with regard to the voluntary assessment. Over fifty per cent of the members had remitted an amount in excess of the minimum of $2.00. Individual cheques had been received as high as $100.00.

P. E. Doncaster, of Winnipeg, stated that any increase in fees should be such that it would not fall heavily on Junior members. In view of the increase in numbers of engineers applying for Junior classification he hoped that there would be no increase in fees that would retard the development. He thought that as these young people eventually become full Members it would be wisest to leave their fees as low as possible until they moved into the higher classification.

The general secretary stated that in the discussions up to the present time there had been no suggestion of increasing the burden on Students or Juniors and that, as a matter of fact, recent changes in the by-laws had actually reduced the annual fee for Students. He also drew attention to the fact that Council is now considering a proposal whereby Students would be transferred to the Junior classification with a transfer fee.

L. E. Westman, of Ottawa, agreed that the Institute would require funds in proportion to the work that it had to do. Referring specifically to the proposal to establish a department of rehabilitation he was of the opinion that in this field, as far as actually directing a man to work was concerned, the government, through its established machinery, would be in an excellent position to assist. He believed that the actual creation of opportunities for returned men was the field in which the Institute could be of greatest assistance. He thought that an expenditure of funds in this job-creating field was a duty of the Institute and other similar organizations. He pointed out that on the one hand there were certain things that the government could do, and then on the other hand there was the new collective bargaining situation facing the engineer, but that, in between, there was a creative field upon which attention should be focussed. He was heartily in accord with the expenditure of money on this creative work and he suggested that better results might be obtained if several organizations worked together to this end.

In response to Mr. Westman's observations, the general secretary stated that there was every intention of utilizing the government organizations and agencies as far as possible, and to eliminate duplication or overlapping of effort. The Institute realized that it had a duty to its members which it could not transfer to anyone else. He explained that already the Headquarters of the Institute is receiving many inquiries from persons who are expecting to leave the services shortly or whose employment with the wartime industry looks as though it were about to be terminated. All such persons were asking for advice and counsel and he felt that the Institute was in a good position to meet these situations because of the support which it received from its members who were employers of engineers. From such sources the very best of information was available. He also explained that a special committee had been set up by Council to define policy and to direct the rehabilitation activity. Major-General Howard Kennedy, M.E.I.C., had accepted the chairmanship and was proposing to secure the co-operation of a Naval and Air Force officer and several industrialists. It was possible that this committee would have a representative in every branch of the Institute in order to give a thoroughly national service.

J. T. Rose, of Winnipeg, suggested that the branches should interest themselves in this rehabilitation programme and that they should encourage their members to become more active with social activities and with service clubs. He thought these fields offered opportunities for job creation.

Election of Officers

The general secretary read the report of the scrutineers appointed to canvass the officers' ballot for the year 1945 as follows:

President: E. P. Fetherstonhaugh, Winnipeg, Manitoba

Vice-Presidents:

Zone A—Western Provinces, R. A. Spencer, Saskatoon
Zone B—Province of Ontario, C. E. Sisson, Toronto
Zone C—Province of Quebec, J. E. Armstrong, Montreal

Councillors:

Vancouver Branch	J. N. Finlayson
Edmonton Branch	C. W. Carry
Saskatchewan Branch	J. McD. Patton
Lakehead Branch	R. B. Chandler
Border Cities Branch	G. G. Henderson
London Branch	J. A. Vance
Toronto Branch	W. H. M. Laughlin
Ottawa Branch	W. L. Saunders
Kingston Branch	R. A. Low
Montreal Branch	R. C. Flitton
	C. C. Lindsay
St. Maurice Valley Branch	J. F. Wickenden
Saguenay Branch	A. Cunningham
Saint John branch	A. A. Turnbull
Halifax Branch	A. E. Flynn

On the motion of J. M. Fleming, seconded by L. Mackay, it was resolved that the report of the scrutineers be adopted, that a vote of thanks be tendered to them for their services in preparing the report, and that the ballot papers be destroyed. Mr. Beaubien announced that in accordance with the usual custom, the incoming president would take over at the end of the annual dinner the following evening.

Retiring President's Address

Mr. Beaubien stated that it was customary for the outgoing president to give his retiring address at this annual business meeting, but as he would be addressing the members again at the special convocation to be held that evening, he thought it would be wise to forego the address at this time. However, he wished to take advantage of this opportunity to tell the membership what a very pleasant and profitable experience it had been for him to be the Institute's representative during the past year. Under prestige of the Institute he had visited all the Institute branches and all the universities from the Atlantic to the Pacific. He could think of no better way of obtaining information and an education in matters pertaining to the engineering profession. As president of the Institute he had been received all over the country by men who were au fait with all that is being done in the engineering field—men who have ideas of their own and who are not afraid to express them. He appreciated very much the reception which he had been accorded from coast to coast, and the splendid support which he had received from the membership at large. During the year, many members of the Institute had done an exceptional amount of work in the general interest, without any return, either personally or officially, except the satisfaction of having done something worthwhile for the profession. He had received good support not only from the membership but from the Headquarters staff, and to all who had received him and who had given such effective help, he extended a most sincere "thank you".

Harry F. Bennett

The president informed the meeting of the sudden death in London, Ontario, on January 31st, of Harry F. Bennett, chairman of the Institute's Committee on the Training and Welfare of the Young Engineer. He commented on the untiring efforts made by Mr. Bennett on behalf of the young engineer and of the organization which had been set up from coast to coast to supply counsel and advice to prospective students, parents and teachers with regard to the profession of engineering.

He stated that the benefits of the long term programme started six years ago were now beginning to be felt. He emphasized the great loss that this would be to this effort and to the Institute in general. He announced that Council had agreed to establish a prize for young men in honour of Mr. Bennett and the work he had accomplished.

Vote of Thanks to retiring Officers

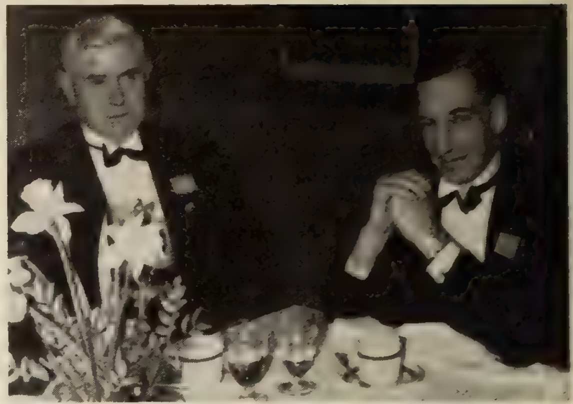
On the motion of Past-President S. G. Porter, seconded by G. S. Roxburgh, it was unanimously resolved that a hearty vote of thanks be accorded to the retiring president and members of Council in appreciation of the work they have done for the Institute during the past year. In presenting the motion, Mr. Porter commented on the great amount of time and energy which Mr. Beaubien had given to the Institute during his excellent year of service.

Vote of Thanks to the Winnipeg Branch

In proposing a vote of thanks to the Winnipeg Branch, Mr. Stirling noted that the president had already commented on the excellent arrangements which had been made. The members of the branch had shown an efficiency and an experience in the conduct of the meeting which had been exceeded in no other part of the country. All in all it had been a very fine exhibition of the hospitality for which western Canada was noted. Mr. Stirling took great pleasure in moving that a hearty vote of thanks be extended to the Winnipeg Branch of the Institute for their hospitality and activity in connection with the holding of the Fifty-Ninth Annual General Meeting. This was seconded by J. M. Patton and carried unanimously.

There being no further business, the meeting adjourned at eleven o'clock a.m.

Head table: Vice-President Col. L. F. Grant, Kingston; Past-President S. G. Porter, Calgary; Guest Speaker A. F. G. Cadenhead; Shawinigan Falls, Que.; the host, de Gaspé Beaubien, Montreal; Past-President K. M. Cameron, Ottawa; not shown in the photo was Past-President C. J. Mackenzie, Ottawa.

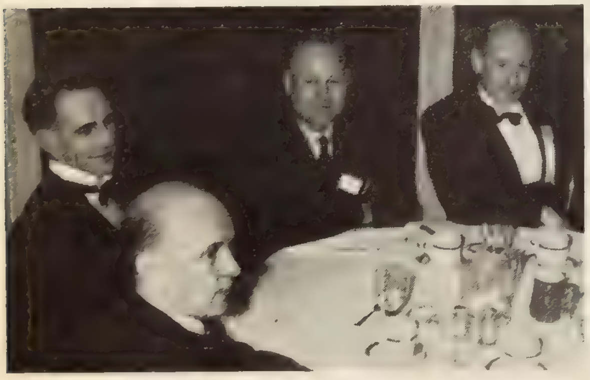


Vice-President G. L. Dickson of Moncton, N.B., with Vice-President J. M. Fleming of Port Arthur, Ont.

Left to right: Dr. P. E. Gagnon, Quebec; Vice-President C. E. Sisson, Toronto; P. M. Sauder, Strathmore, Alta.; Arthur Jackson, Kingston; H. L. Briggs, Winnipeg; A. W. F. McQueen, Niagara Falls.

N. H. Eager, Hamilton; C. K. McLeod, Montreal; T. H. Kirby, E. V. Caton, Prof. N. M. Hall, all three from Winnipeg; J. G. Hall, Toronto.

Dean E. P. Fetherstonhaugh, Winnipeg; G. A. Gaherty, Montreal; Prof. E. O. Turner, Fredericton; E. P. Muntz, Montreal; W. L. Saunders, Ottawa.



Left to right: T. E. Storey, Winnipeg; S. H. deJong, Toronto; C. P. Haltalin and V. W. Dick, both of Winnipeg.

R. B. Chandler, Port Arthur; L. Austin Wright, Montreal; J. A. Vance, Woodstock, Ont.; R. S. Eadie, Montreal.

From left to right: F. V. Seibert, chairman of the Annual Meeting Committee, Winnipeg; C. W. Carry, Edmonton; Stewart Young, Regina; J. M. Patton, Regina; H. B. LeBourveau, Calgary, and J. W. MacDonald of Halifax.

From left to right: E. V. Gage, Montreal; H. E. Brandon, Toronto; E. B. Martin, Moncton; Alex. Love, Hamilton; Vice-President J. E. Armstrong, Montreal; Carl Stenbol, Sault Ste. Marie; H. J. Ward, Shawinigan Falls, Que.

ANNUAL PROFESSIONAL MEETING

It grows increasingly difficult to give an adequate account of an annual meeting. Each year new heights are attained, both in quality and quantity, and the superlatives used in the account of the previous meeting are equally appropriate to the latest meeting. In this way such accounts tend to become but a repetition.

Certainly the meeting at Winnipeg did not reduce the acceleration of success that has been created. With an unusually full programme of unusually fine technical sessions, with social events of the most pleasing character, with a local committee of great capacity and foresight and withal an attendance of seven hundred and fifty, there was every reason to carry away the impression that no meeting could be more enjoyable, more profitable, or more completely successful.

When Winnipeg was first considered as a meeting place there were doubts and qualms in the minds of many. Was it too far away from the larger centres? Were there enough engineers there to establish a reasonable attendance? Could a programme of professional papers be set up that would appeal to a western audience and at the same time draw people from the east? How about transportation? Could the hotels meet the demand? And how about the weather? Fortunately these considerations were resolved into an affirmative decision, and another merit mark was added to the Institute's record of achievement.

To the Winnipeg committee and members goes the credit for everything. Within the memory of Institute officers, there was never a meeting where arrangements were so well and so fully prepared in advance. No detail was overlooked or neglected; no hitches or delays were allowed to occur. It was difficult to realize that the Institute had not met there for thirty-four years. The committee's work was done so well that one would think the meeting had been there every year. It is likely that not many years will be allowed to pass before Winnipeg is again sought out to act as host.

There is no need to go into the details of the programme. It has been published in the *Journal*, but there are several features that should be touched on for the double purpose of showing appreciation to the contributors, and of informing those members who were not fortunate enough to be there.

The Council meeting held on Feb. 6th was attended by forty-five persons, thirty-one being councillors. This makes it one of the largest and probably the most representative meeting ever held in any part of Canada. Councillors were there from twenty branches out of twenty-five.

The retiring president's dinner—always an outstanding event—was no less outstanding on this occasion. Mr. Beaubien entertained his councillors, committee chairmen and past presidents to the number of fifty-five. A special feature was the address by A. F. G. Cadenhead, M.E.I.C., on "Canada's Need of Research", which appears in this *Journal*. Following the usual custom, all past presidents were called on by the president. Messrs. Porter, Cameron and Mackenzie acquitted themselves gracefully and effectively as past presidents always do.

Professional Sessions

Many persons were of the opinion that better papers had never been presented at an annual meeting. All sessions were outstanding because of the timeliness of the subjects and the quality of the papers. It is believed that the information disclosed by these papers and the inspiration they provided for further thinking will aid materially in advancing the topics in the interests of the general public.

A noticeable feature about the authors was that they were mostly young men. It is a pleasant thought that so many young engineers have gone so far in their chosen fields, and that their careers are still mostly ahead of them. It is indeed a bright prospect for the future of the profession and for the Institute.

Convocation

An unusual feature of great colour and impressiveness was the special convocation held by the University of Manitoba for the purpose of granting to deGaspé Beaubien an honorary degree of Doctor of Science—the first such degree ever granted by Manitoba. Before a capacity audience and under the guidance of Dr. H. P. Armes, president of the University and E. P. Fetherstonhaugh, dean of Engineering and Architecture, Chancellor A. K. Dysart, in strict conformity with ancient custom, declared the retiring president of the Institute to be "Dr." deGaspé Beaubien *honoris causa* "with all the rights and privileges pertaining thereto".

In reply, Dr. Beaubien expressed his thanks, and spoke in some detail on the relationship of the universities to the professional consciousness of the engineer, and of the engineers' need to remain a professional man in spite of today's trends in labour and industry.

Engineers everywhere will be grateful to the University of Manitoba for the recognition it has given to an outstanding Canadian—a recognition which the profession itself has accorded for many years.

Special Speakers

The addresses of the luncheon and dinner speakers have already appeared or are printed in this issue of the *Journal*. Each made a fine contribution to the success of the meeting. John S. Galbraith, M.E.I.C., spoke on "The Community and the Engineer" at the first luncheon and, at the second luncheon, George Spence took as his subject "Post War Projects for the Prairies".

AT THE ANNUAL DINNER

Head table: His Honour Lieut.-Gov. R. F. McWilliams, Mme de Gaspé Beaubien, President H. P. Armes of the University of Manitoba, Mrs. Stuart S. Garson and A. G. F. Cadenhead.

Premier Stuart S. Garson of Manitoba speaks on the design of a tax structure.

Dr. Beaubien hands over the reins of office to Dean Fetherstonhaugh, while Premier Garson, on the left, and Lieut.-Gov. McWilliams, on the right, applaud.

President E. P. Fetherstonhaugh acknowledges the honour of the presidency.

R. A. H. Hayes of Montreal receives the R. A. Ross Medal.

Dean E. P. Fetherstonhaugh of Winnipeg and J. A. Wilson of Ottawa are presented, by Mrs. R. F. McWilliams, with Julian C. Smith Medals "for achievement in the development of Canada".

SPEAKERS AND AUTHORS

Dr. deGaspé Beaubien acknowledges the honorary degree of Doctor of Science from the University of Manitoba.

In the receiving line at the annual dance. President and Mrs. Fetherstonhaugh, Past-President Beaubien, W. E. Bonn and Mrs. Bonn (in the foreground), of Toronto.

Mayor Garnet Coulter welcomes the 550 guests to the banquet tendered by the City of Winnipeg, on the occasion of the annual meeting.

John S. Galbraith of Ottawa speaks on Community Planning and the Engineer at the first luncheon.

George Spence of Regina tells of Post War Projects for the Prairies at the second luncheon. To the left is Mrs. A. E. Macdonald, convenor of the Ladies' Committee.

Left—Robert Peterson of Saskatoon presented a well illustrated paper on the application of soil mechanics to the construction of earth dams.

Right—Prof. M. S. Coover of Ames, Iowa, vice-president of the American Institute of Electrical Engineers, and Hon. E. F. Wil'is, Minister of Public Works of Manitoba.

W. E. Bonn, Toronto; Vice-President R. A. Spencer, Saskatoon; J. A. Vance, Woodstock, Ont.; General Secretary Dr. L. Austin Wright and Prof. M. S. Coover of Ames, Iowa, vice-president of the A.I.E.E.

At the Council meeting: H. J. Ward, Alex. Love, L. F. Grant, C. E. Sisson. In foreground, Carl Stenbol.

Chairman T. H. Kirby of the Winnipeg Branch presided at the first luncheon.

Miss F. Thompson, Vice-President C. K. McLeod and Miss M. McLaren, all of Montreal.

Professor G. H. Herriot, Winnipeg; C. Hay and W. P. Cheney of Regina.

The arrangements for registration were planned and carried out with the utmost in efficiency.

C. V. Antenbring, chairman of the Registration Committee discusses a fine point with R. A. Sara, chairman of the Publicity Committee.

Geo. E. Cole, president of the Association of Professional Engineers of Manitoba chats with Major Patrick A. O'Connor, D.E.O., M.D. No. 10, Winnipeg.

Caught on the steps: C. Chagnon and G. Molleur from Montreal; A. E. Paré from Quebec and L. Daoust of Winnipeg.

J. T. Dyment and Mrs. Dyment of Winnipeg.

Professor I. M. Fraser of Saskatoon discusses rehabilitation with General G. R. Turner of Ottawa.

At the dinner on Thursday, Stuart S. Garson, Premier of Manitoba, spoke on "The Importance of Design in a Tax Structure". All three addresses were excellent. The short address of welcome given by R. F. McWilliams, Lieutenant-Governor of Manitoba, was particularly appropriate. It also appears in this *Journal.*

Complimentary Banquet

There is no record of any municipal corporation having previously welcomed the Institute with a complimentary banquet. The City of Winnipeg on Wednesday had as its guests for dinner five hundred and fifty engineers and their wives. With Alderman H. C. Morrison in the chair, and Mayor Garnet Coulter as speaker, the engineers were made to feel very welcome in "the gateway to the West". It was indeed a splendid gesture of welcome and because of it, many persons will have taken away with them a new appreciation of Winnipeg and a desire to return again.

The Annual Dinner

Always the outstanding event of the annual meeting, the annual dinner again added lustre to the Institute's history. The attendance of almost six hundred taxed the hotel facilities to the limit, but the hotel staff performed miracles of skill and patience to the end that no one was neglected and all voted the service to be excellent.

At head table, besides the president and Mme. Beaubien and the president-elect and Mrs. Fetherstonhaugh, there were the Lieutenant-Governor and Mrs. McWilliams, the Premier and Mrs. Garson, the Minister of Public Works and Mrs. Willis, and representatives of sister societies such as the American Institute of Electrical Engineers, (Vice-President M. S. Coover and Mrs. Coover of Ames, Iowa), the Chemical Institute of Canada (President A. F. G. Cadenhead and Mrs. Cadenhead, of Shawinigan Falls), the Canadian Institute of Mining and Metallurgy (A. A. Mackay of Montreal, president), the Dominion Council of Professional Engineers (P. Burke-Gaffney of Winnipeg, vice-president, and Mrs. Burke-Gaffney), the Association of Professional Engineers of Manitoba (George E. Cole of Winnipeg, president), Association of Professional Engineers of Saskatchewan (J. M. Patton of Regina, president), Royal Architectural Institute of Canada (Professor M. S. Osborne of Winnipeg, vice-president, and Mrs. Osborne), Canadian Construction Association (J. B. Stirling of Montreal, past-president) Canadian National Railways (W. R. Devenish, of Winnipeg, vice-president), Canadian Pacific Railway Company (W. A. Mather, of Winnipeg, vice-president, and Mrs. Mather).

Presentation of Prizes

The medals and awards of the Institute were a feature of the after dinner programme. As the citations were

(*Photo Winnipeg Tribune*)

Dean E. P. Fetherstonhaugh reads the citation which accompanied the conferring of the honorary degree of Doctor of Science upon de Gaspé Beaubien. Seated in the foreground is His Honour Lieutenant-Governor R. F. McWilliams, while standing on the right is Mr. Justice A. K. Dysart, Chancellor of the University.

read by J. W. Sanger, the following members were presented to Mrs. R. F. McWilliams, who very graciously made the presentations:

Gzowski Medal—W. Griesbach, M.E.I.C.; Plummer Gold Medal—Dr. Wilfred Gallay; Keefer Medal—M. V. Sauer, M.E.I.C.; Ross Medal—R. A. H. Hayes, M.E.I.C.; Julian C. Smith Medals—Dean E. P. Fetherstonhaugh, M.E.I.C., and J. A. Wilson, M.E.I.C.

Induction of New President

The last item on the evening's programme was the induction of Dean E. P. Fetherstonhaugh into the chair of the presidency. He was conducted to the chair by Past-Presidents Porter and Cameron where retiring President Beaubien received him and handed over the gavel and the authority. It was a rousing reception that greeted the new incumbent of office. Dean Fetherstonhaugh would be well received anywhere, but in Winnipeg his home city, he was greeted with an enthusiasm that was a warm and stirring tribute. Those from outside Winnipeg were glad to join with the Winnipeggers in this demonstration to a fine gentleman.

Reception and Dance

Following the dinner, President Fetherstonhaugh and Mrs. Fetherstonhaugh, Past-President Dr. and Mrs. deGaspé Beaubien, and T. H. Kirby, chairman of the branch and Mrs. Kirby, received the members and guests in the Crystal Ballroom. This was followed by dancing, a diversion that was appreciated by a very large number. Unlike the professional sessions, this activity was not monopolized by the younger people, proving that the style in professional topics may change from year to year, but the style in amateur dancing, remains constant as far as the individual is concerned no matter what its vintage.

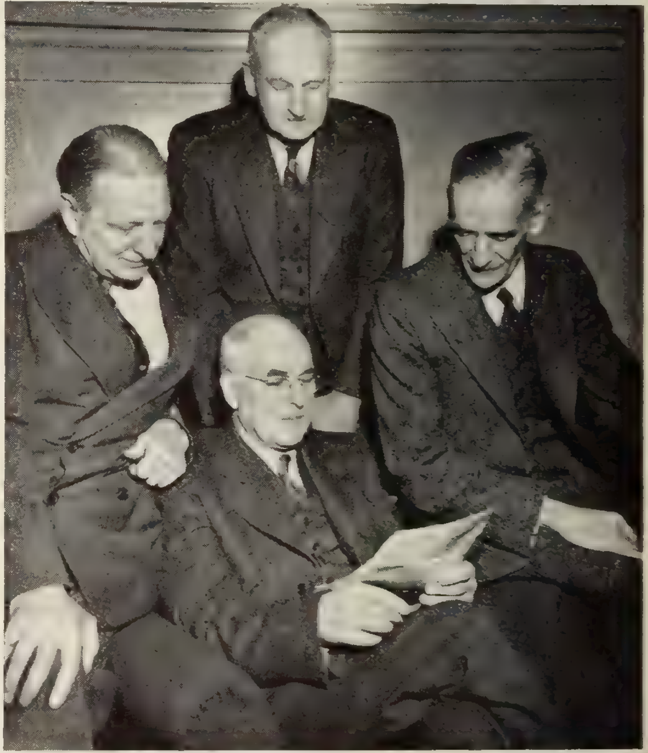
To the members in Winnipeg, other members are deeply grateful for an enjoyable and profitable experience. They will look forward with pleasurable anticipation to being guests again in that hospitable city.

The Students

A noticeable feature of all meetings was the presence of a large number of students. They took a prominent part in carrying out arrangements, and they attended professional sessions. A special issue of the university paper, the *Manitoban,* was prepared entirely by the engineering students, and distributed free to the meeting. A special "Convention Issue" of *The Slide-Rule* was also prepared for the meeting. This is the only literary magazine published by any engineering faculty in Canada, and reflects great credit on Manitoba students. The quality of the material is excellent, and proves that the paralysis of creative literary abiilty from which the profession is supposed to suffer has been overcome at Manitoba.

"Muriel's Room"

Descending (or ascending—as you wish) from the professional to the social, no account would be complete without referring to the social centre that has come to be known as "Muriel's Room". These arrangements were carried out entirely by friends of the Institute, and carried out excellently. The opportunity to meet between and after professional discussions, to renew old and make new friendships, is one of the precious values of Institute meetings. "All work and no play makes Jack a dull boy", and "Men cannot live by bread alone" seem to be appropriate and justifying references. Certain it is that these friends have gone a long way to lighten an otherwise heavy programme. The Institute is indeed grateful to them.



(*Photo Winnipeg Tribune*)

Studying the agenda of the annual meeting are shown: seated in the centre, Past-President S. G. Porter, Calgary; around him from left to right, Dr. L. Austin Wright, general secretary; Retiring President de Gaspé Beaubien and Incoming President Dean E. P. Fetherstonhaugh.

SAID AT THE ANNUAL MEETING

Abridgements of Speeches of Particular Interest

President Armes Opens Convocation

Mr. Chancellor, Your Honour:

The Convocation of the University this afternoon has been assembled for the purpose of honouring a distinguished member of the profession of engineering on the occasion of the gathering from all parts of Canada of professional engineers in Winnipeg. I have much pleasure in extending to the many engineers attending the Annual Meeting of The Engineering Institute of Canada the greetings and welcome of The University of Manitoba, and in conveying to them the cordial wishes of the members of the University for the successful attainment of the objectives of their sessions.

The universities have a close and intimate connection with the profession of engineering, the members of the Institute and of other professional bodies being almost exclusively graduates of the universities. In Canada it is the universities that have undertaken the training of the engineer to enter the practice of the profession. The debate as to whether technology should find a place in the universities fortunately never disturbed the minds of those responsible for the development of our Canadian institutions, despite the fact that, in some other countries, the entry of technical studies was vigorously resisted.

In our own University, the departments of engineering were among the earliest to be established, being preceded only by those of mathematics and the fundamental sciences. The University of Manitoba, through its departments of engineering, has contributed a share to the growth and development of Canada, and particularly of this central region of the country, by the training of well qualified men to assume the direction of construction and the utilization of natural resources. I venture, on this occasion, to express the hope that The University of Manitoba may be able, in the near future, to extend its work in education by opening instruction in branches of engineering that hitherto have found no place in its curriculum.

In the field of original investigation in engineering the universities have a clear task and duty—the task of providing, for those men who may be especially adapted to research, a training in methods and a development of abilities that will ensure the supply of men who will carry forward the work of discovery and of the extension of knowledge and of its application for the benefit of mankind. Some research may best be done in the universities, some types best in public institutions such as the National Research Council's laboratories, and some in industry itself. On the universities, however, devolves the task of the initial training of young research workers. The Engineering Institute, and the other groups of engineers in Canada, have a clearly defined place in maintaining and advancing the standard of education and research. May the universities bespeak the interest and influence of these professional bodies in the furthering of their efforts.

The engineer who will shortly become an alumnus of the University, and the first to be admitted to the degree of Doctor of Science, will be presented to you by a brother engineer, the Dean of the Faculty. May I only say, in opening this Convocation, that The University of Manitoba deems it a high privilege to be able to honour the distinguished president of The Engineering Institute of Canada.

I now declare this Convocation open for the conferring of the degree of Doctor of Science.

Dr. Beaubien on Professional Consciousness

From Convocation Address—February 7th, 1945

Mr. President, gentlemen of the Senate, and gentlemen of the University of Manitoba:

My first words are to thank you for the honour you have conferred upon the engineering profession, as represented by The Engineering Institute of Canada, by awarding a Doctor's degree to its president.

As an unworthy incumbent of that high office, I take great pride in such a signal honour. May I tell you also that The Engineering Institute of Canada is deeply grateful for your courteous recognition of the services it has endeavoured to render to the country and to the engineering profession.

The industrial development of Canada, of which we have reason to be proud, has been brought about chiefly by the knowledge, ingenuity and labour of engineers. By their achievements, they have demonstrated the existence of very high professional idealism.

The problems of labour relations, resulting from the industrial development of these war years, have caused the enactment of labour protecting laws and numerous social measures which tend to divide society into groups with distinct interests, each with its own adherents and spokesmen. These laws have further occasioned a great number of utterances in Parliament, in labour circles, in political campaigns and in the press. These, by implication if not by direct statement, pictured the groups in turn, as in need of protection and greater remuneration. Public approval of these utterances, or its indifference, leave the groups with the conviction that they have been overworked. The result of these discussions is to dampen the incentive to hard work and to leave the impression that high return from one's labour may be enjoyed independently from his individual production.

Such constantly repeated ideas cannot but have effect upon our individual effort and, more specially, on the younger professional man whose occupations and preoccupations of establishing himself prevent him from giving to these utterances the thought necessary to separate what is beneficial from what is fallacy.

There thus appears a threat, not only to the general welfare but, what is perhaps of more concern to you, in the University and to us in the Institute, a threat to professional achievement and idealism which can only come from hard work.

For those who have faith in humanity and its struggle to attain ever higher degrees of perfection, professional spirit is too precious to be abandoned; too precious for us not to strive to the utmost, so that it may endure and grow.

. . . .

Our professional spirit is something for which we have a very high regard; without understanding it clearly, we know that it is something without which we would be left aimless, as a navigator is when he loses the star guiding his ship. It is something for which we have an attachment, the strength of which we realize only when we fear to lose it. Few analyze it and still fewer attempt to define it.

Dr. W. E. Wickenden, in his admirable address "The Second Mile", delivered before the Institute in 1941, does not define professional spirit, but his paper contains the most attractive and satisfying description of it and what it will do, that it has been possible for me to find. I take the liberty to quote from it:

"What is the distinctive mark of the professional man? First, we may say that it is a type of activity which carries high individual responsibility and which applies special skill to problems on a distinctly intellectual plane. Second, we may say that it is motive of service, associated with limited rewards as distinct from profit. Third, is the motive of self-expression, which implies joy and pride on one's work and a self-imposed standard of excellence. And fourth, is a conscious recognition of social duty to be fulfilled among other means by guarding the ideals and standards of one's profession, by advancing it in public understanding and esteem, by sharing advances in technical knowledge, and by rendering gratuitous public service, in addition to that for ordinary compensation, as a return to society for special advantages of education and status."

Again I quote:

"By common consent, the quality most universal and indispensable among engineers is integrity; this is essentially something moral or idealistic. Ranking almost equal with integrity is devotion to duty; given a job, an engineer will see it through, come hell or high water; and so on through the whole catalogue of the engineer's distinctive virtues. Why is he so? Because a boss or a time-clock is policing his efforts? Or a money incentive drives him? Or hoped-for applause urges him on? Well, hardly! Because he has had a soldier-like training and indoctrination? In some small measure. Because he has a tradition to uphold? Yes, no doubt. Or is it because of something within himself to which he dare not be disloyal, and a faith between himself and his colleagues—unspoken perhaps—which he dare not betray?"

There does not appear to be much doubt that the urge to travel the second and voluntary mile is made up in large share of the sense of responsibility, responsibility to ourselves; to our work; to our profession; and to humanity generally.

With the present-day tendency in the evolution of thought in industry toward a lessening of this sense of responsibility, what will happen to future production and what will become of the young engineer of tomorrow and his professional idealism?

Already there is a move by the labour unions to take him willy-nilly into their organization. Can he maintain his professional spirit unimpaired while a member of a labour union? Some labour men think not. If the engineering profession and management in industry are to become the sole guardians of the sense of responsibility, what will happen when the young engineer is promoted to these positions of trusteeship from the ranks of labour unions?

Notwithstanding the fact that we are in the midst of a most terrific struggle, a struggle we are forced to wage in order to protect the way of life to which we are wedded; notwithstanding the example of heroism of our men under arms who, day and night, risk their lives in accomplishing a task so arduous as to be limited only by their physical endurance; notwithstanding that we have constantly before us the example of our men at the front who endure, and who receive a mere pittance in comparison to what we are paid at home; notwithstanding that we have constantly before our eyes the devotion to duty of administrators and professional men who, alone, bear the bulk of responsibility; notwithstanding all this, the tendency to seek relief from responsibility is not only apparent but apparently increasing.

If this be the case now, what shall we find after the war? Is it not natural that relief from the anxiety of actual combat, and from worry for the lives of those dear to us, will tend to dampen our efforts? And this, in the period following the cessation of hostilities when so many new problems will have to be solved.

This growing tendency and these problems will require careful thought. The solution to the problem of production realized by the fear of unemployment and maybe hunger is only temporary and not the solution that we should strive to attain. Any temporary relief attained in this manner would tend to lower further our professional ideals.

Canada's effort in producing war material has been magnificent. With a population of something under 4 per cent of that of the Allies, we have contributed to the joint metal pool in the following proportions:

85 per cent of the nickel
20 per cent of the zinc
14 per cent of the copper
19 per cent of the lead
78 per cent of the asbestos
and 35 per cent of the aluminum

The production of these metals has necessitated the development of hydro-electric power, mines and refineries; this incidental effort is itself of no mean proportion.

With a population of barely twelve millions, Canada is maintaining about 1,000,000 men under arms and, while doing so, its industry has expanded and has produced a truly fantastic amount of war equipment, in addition to a very much increased agricultural production. To quote a few figures on our production of war material, we have made:

314	10,000-ton ships, delivered
368	Frigates, corvettes, mine sweepers
4,771	Service aircraft
9,949	Trainer aircraft
3,640	Tanks
2,175	Self-propelled gun mounts
30,881	Personnel and equipment carriers
9,242	Other armoured vehicles
707,103	Mechanical transport units

We have produced communication equipment instruments, machine guns and carbines, rifles and small arms by the millions and small arms ammunition by the billion rounds.

Let me further tell you that the quality of the material produced is as high as its volume. The new methods of manufacture developed in Canada, the number of new processes which originated here, the new products developed in the laboratories of the National Research Council and in those of our industries are evidence that our technicians have the imagination, the knowledge and the skill to continue to develop that industry at its accelerated rate.

This magnificent achievement is evidence of how willing our engineers have been to tread Dr. Wickenden's Second Mile. Unstintingly they have worked for our war effort, and for our country, without regard to time or labour. No better evidence of their high professional spirit can be given than the achievements of our engineers.

This idealism is worth careful nursing, in order that it may endure, not only for our material advancement, but for its sheer beauty.

Unfortunately our inspiration and our sense of responsibility have led us to build engines of destruction. How beneficial it would be for Canada and for humanity if that same inspiration and sense of responsibility could allow us to create instruments for the production of commodities of which we are in sad need!

My remarks may induce those who are in a position to help, to give thought to a subject vital to our welfare. If, in the midst of their "round of tasks and duties", the professor and the engineer are thus persuaded to consider the maintenance of high idealism in the profession of engineering, my object will have been achieved.

The object of this short talk is not to determine what steps should be adopted to promote high professional idealism, but simply to urge that thought be given the subject.

The problem appears to be educational, and more within the scope of the university than that of the engineer. The engineer can help, however. How ? That depends on local conditions which he, himself, can best work out.

Welcome From Lieutenant-Governor

His Honour R. F. McWilliams at the Annual Dinner

But, Mr. President, in addition to the personal reasons which I have mentioned, I want to welcome you and your colleagues to the province of Manitoba with very special heartiness because of what you stand for.

The people of Canada have been engaged for many years in a stupendous undertaking—the building of a united nation out of most diverse elements and almost in defiance of geography. To accomplish what we have already achieved, we have required the leadership of two types of people above all others. We have needed statesmen, men of vision and courage and determination to build a nation in spite of all obstacles, and to create a united people in spite of all differences. And engineers, who had the skill and the courage to face what looked like overwhelming difficulties and achieve success. Through the skill and determination of your profession, we have built great transcontinental railways; we have opened waterways half way across the continent; we have harnessed the resources of Niagara and many other great rivers; we have opened the way into the vast hinterland while all the time building cities and industries and homes rivalling those of any other nation. For these achievements, we have to thank our engineers, and we, in Manitoba, which was for more than forty years an island in the vast sea of distance hundreds of miles from everywhere, have a very special reason for appreciating the service of those who have made it possible for us to be intimately connected with every other part of the continent.

And, Mr. President, in addition to all these personal and professional reasons for welcoming you to Manitoba, I want also to give you a very special welcome as one of the leaders of that great race which, from the very beginning of our history, has contributed so much to the up-building of this nation. Your people set themselves to the achievement of greatness in three intellectual fields—the church, the law, and in public life—and you have achieved great success in all of these fields. The names of Laurier, Cartier, Lafontaine, Chapleau, Lapointe, stand out as amongst the greatest names in Canadian history. In my own profession, men like Mr. Geoffrion and the late Mr. Lafleur rose to the leadership of the Bar of the Dominion though they had to win their successes in fields of law different to that in which they had been bred, and in a language that was not their native tongue. While your people won great successes in these fields, they made little effort to achieve eminence in those practical professional fields—banking, commerce, industry, engineering. Now I see great changes in Quebec. Your people are turning their attention to these newer fields, and the character and the ability which has won them such high places in the older professions will win for them similar eminence in the newer fields. You, Sir, are one of the leaders of the newer Quebec, and we welcome you because we see in this a force drawing our peoples closer together, breaking down the barriers that have separated us, and uniting all of us in a common determination to put the best that each of us has to contribute into a common effort to make of this country one of which we shall be most justly proud and to make the name Canadian honoured in every other land.

There seems to be a feeling in your province, if we may judge by newspaper talk, that there is an antagonism towards your province and your people in other parts of Canada. I cannot say how much of this feeling there is in other provinces, but I can and I do want to say to you that in the province of Manitoba there is no antagonism to Quebec and no antagonism to the French-Canadian people whether they live in Quebec or in any other part of Canada. We have but one complaint to make against you. In the early days of this province, you sent to us many able men who achieved high places in the life of this province. Our complaint is that you have not continued to do so, but have kept your best for yourselves. To you and your colleagues from the province of Quebec, of whatever race or creed, as well as to those from other provinces, we in Manitoba wish to extend the heartiest welcome we can give, and to express the hope that, having made this city the meeting place of your convention after many years of absence, you will feel that you want to come back to us soon and often.

From Month to Month

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

COLLECTIVE BARGAINING

The Minister of Labour's response to the request of the Committee of Fourteen for a separate order in council to control collective bargaining for the professions leaves the professions just about where they were. There has been no open denial of the request and yet no acceptance—just a statement to the effect that the professions will come within the jurisdiction of the present order, but will be recognized as a bargaining unit "in a proper case", this procedure to apply for an experimental period of six months "and thereafter until otherwise determined".

Just what the Committee of Fourteen or the Subcommittee of Three will do about it remains to be seen. At time of going to press the *Journal* is not aware of any decision having been reached, but understands there have been preliminary conversations between members of the sub-committee.

The Minister's letter addressed to the chairman of the Committee of Fourteen is as follows:

"Dear Mr. MacRae:

"The Wartime Labour Relations Board, after hearing your representations on behalf of the above named institutes and the representations of other organizations, finds that the cost of a New National Board and the necessary Provincial Boards to deal with professional employees would be substantial and that the proposal to include professional employees who influence the hiring or discharging of scientific personnel would not work out satisfactorily

"The Board recommends that the present Regulations be continued for a further period of six months and thereafter until otherwise determined, the Board meanwhile sub-dividing 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. It is felt that this course will give professional employees an opportunity to acquire some experience in collective bargaining, if they so desire, and when they have this experience they will be in a position to decide as to what kind of collective bargaining they want. The Board will review its recommendation after the end of the six months' period. In my opinion, the procedure recommended by the Board should be given a fair trial and to this extent the Board's recommendation is adopted.

Yours sincerely,

(*Signed*) HUMPHREY MITCHELL.

COSTS OF NEGOTIATIONS

So that members of professional and technical organizations may appreciate more fully what their societies have done for them in the study of and negotiations for collective bargaining, it may be useful to report that up to the end of 1944, the sum of $1,490.00 has been spent by the committee of fourteen for legal advice, stenographic and other expenses. This does not include anything for the expenses of delegates, each organization assuming all costs that are related specifically to its own membership.

This common or cooperative cost has been distributed between societies as follows:

The Engineering Institute of Canada	$ 470.00
Canadian Institute of Mining and Metallurgy	300.00
Dominion Council of Professional Engineers	200.00
Chemical Institute of Canada	200.00
Royal Architectural Institute of Canada	100.00
American Institute Electrical Engineers (Canadian Section)	100.00
Institute of Radio Engineers (Canadian Section)	50.00
Canadian Society of Forest Engineers	50.00
Canadian Institute of Surveying	10.00
Junior Engineers, Ottawa	10.00
	$1,490.00

In addition, in the interests of the members, the Institute has incurred further expenses of approximately $550.00, making the total cost to this organization $1,020.00 up to the end of 1944.

Other organizations' experience will be similar to that of the Institute and when all are added together it will make a fair sum. It is evident that modern trends are going to raise the costs of maintaining a profession in Canada, and that the expenditures so far incurred are merely "a drop in the bucket".

THE ARCHITECT-ENGINEER SITUATION

Several members have expressed an interest in seeing the plaintiff's factum in the case of the Association of Architects of Quebec versus Brian R. Perry. In the February *Journal* the factum of the defendant was published, but only quotations from the plaintiff's were cited. Both arguments would have been printed in the *Journal*, but that the paper restrictions made it difficult. The plaintiff's "plaint" is forty-five foolscap pages in length, double spaced.

The *Journal* would have been delighted to bring this document to the attention of every engineer, because it is an excellent exhibition of how issues can be confused, relevant facts ignored or submerged, and extraneous statements offered blandly as though they were of some importance. Incidentally, from the point of view of composition, it would have been comforting to engineers, who upon occasion are accused of falling short of perfection in such matters, to see the work of a member of one of the talking professions.

If enough members are interested in seeing this "masterpiece" it is believed that mimeographed copies can be obtained at cost through the Institute. Copies of the judgment too could be supplied on the same basis.

While it is desirable to keep members informed fully, it is unwise to discuss tactics publicly, and therefore there is little information to be given now. Members may be assured that those concerned are fully aware of the seriousness of the situation, and will take every means to preserve for the profession the rights to which it has always been entitled, and to maintain for the public the protection which it requires.

Erratum

In the editorial appearing on p. 101 of last month's issue reference was made to a dictionary definition of "works", quoted by Mr. Justice Tyndale in his judgment. Unfortunately in the retyping for the *Journal* an important part of the definition was dropped; the words "a building" were omitted. It should have read according to the judge's written document, "Works—an architectural or engineering structure; a building, edifice."

Even though this reference is made simply to correct the previous error, it is difficult to refrain from contrasting the definition with the judge's decision. The engineers' act says "works" is in the field of the engineer. This definition says "works" is a structure, a building or an edifice that may be either or both architectural and engineering in nature, but the judge says a machine shop may not be designed by an engineer. It doesn't seem to make sense.

TOO MANY ENGINEERS?

Every profession believes there are too many in it. It is a natural conclusion, because only a few in each profession seem to earn sufficient to satisfy their needs. Low incomes are attributed almost entirely to an excess of supply in relationship to demand, and hence the belief that the supply should not be increased too greatly.

To those who have worried about the earnings of the profession—and who hasn't ?—it will be cold comfort to read the statement issued not long ago by the R.C.A.F., to the effect that a survey of 13,500 personnel in the force revealed that the largest group was interested in engineering upon discharge. The figure was 1,300. Multiply this by the factor that would relate it to the total personnel in the R.C.A.F. and we have the interesting total of 18,000.

This may not be a fair way of developing the total impact on the profession, because it is stated by the R.C.A.F. that in the group surveyed the majority was ground crew who had had some mechanical training. However, when account is taken of the higher educational requirements for air crew, it looks as though even more of them might be interested in the same calling, because of the easier approach they would have to admission to study.

Recently the Wartime Bureau of Technical Personnel made an interesting study of supply and demand for the profession of engineering. It is surprising to see how many persons go off the list each year because of retirement or the grim reaper. It is about equal to half the number of graduates produced each spring. Of course these Bureau figures are based on war conditions under which the supply has remained constant while the demand has increased; but even so the figures are not too alarming when translated to peace time conditions.

Out of 1,350 graduates each year in engineering and science, 1,200 have been going into the forces annually as technical personnel, in addition to which there are from three to four thousand in the forces in non-technical positions. This indicates that upon cessation of hostilities industry will have a tremendous back log of opportunities for engineers. To meet this it may be necessary for a few years to have an increased production from the universities, Under such circumstances the influx of greater numbers should be accommodated without fear of a supply beyond the demand.

There is no doubt but that as far as universities are concerned, the numbers entering upon demobilization will be great, but not all who have expressed an interest will enroll. The real worry to the profession is not so much the number who will complete a university course but the greater number who will perhaps consider themselves to be engineers because of certain intensified training received in the services, and who will compete in the lower brackets with young graduates. This could be a really serious matter for all concerned.

CO-OPERATION WITH QUEBEC CORPORATION

This number of the *Journal* is being mailed to those members of the Corporation of Professional Engineers of Quebec who have not as yet joined the Institute, in the hope that, through it, they may become better acquainted with Institute activities. The Corporation has already sent copies of its latest *Bulletin* to our members in the province of Quebec not registered with the provincial body.

This exchange of courtesies has the additional advantage of providing a more complete file of the publications for those who will in the next few weeks take advantage of the special privileges of joint membership provided in the recent agreement between the Institute and the Corporation.

Members of either organization who do not belong to the other are reminded that the privilege of admission without paying the entrance fee expires on April 21st. All have been sent the necessary application forms and it is hoped they will become joint members, thus effectively confirming the majority vote given, at the end of last year, in favour of co-operation.

THE QUEBEC FEDERATION OF PROFESSIONAL EMPLOYEES IN APPLIED SCIENCE AND RESEARCH

The following article, which is reprinted from the February *Bulletin* of the Corporation of Professional Engineers of Quebec, gives the latest developments in the organization of a collective bargaining agency for engineers in this province.

" On January 12th last, the Corporation's Committee on Collective Bargaining studied the reports and findings of other committees on collective bargaining and thoroughly reviewed the situation in the light of the latest developments.

" The Committee then worded a resolution addressed to the Council of the Corporation, recommending that the ' Quebec Federation of Professional Employees in Applied Science and Research ' be recognized as the appropriate body to cover the field of collective bargaining for professional employees. The resolution further recommended that Council favour the immediate setting into action of the Federation.

" The Corporation's Council, which had studied the Federation's constitution at an earlier date, approved on January 13th, the resolution of its Committee on Collective Bargaining.

" On January 31st a group of interested professional employees gathered and signed a memorandum of agreement, forming themselves into the association to be known as the ' Quebec Federation of Professional Employees in Applied Science and Research '. An Executive Board of five, composed as follows, was selected from among these first members: A. R. Colman, President; A. Clement, Vice-President; Marc

Boyer, Secretary-Treasurer; W. A. Nichols and J. D. Sylvester.

" The Federation is presently recruiting its members. It has prepared for distribution a very comprehensive memoir on collective bargaining. This memoir explains the value of collective bargaining procedure to the professions. It recounts the steps taken since April, 1944, by the several professional associations and societies. It explains the set-up of the Federation and it tenders an invitation to all concerned to join its membership.

"Although the inception of the Federation was fostered by the Corporation and by several professional societies, the Federation is an autonomous, self supporting entity. But the close affinity of its policy and purpose with that of the existing professional governing bodies and voluntary professional association naturally invites their co-operation."

PRESIDENT'S MARITIME TOUR

The *Journal* presents herewith the itinerary for the president's tour of the Maritime branches and universities.

President Fetherstonhaugh will be accompanied by Mrs. Fetherstonhaugh and Dr. L. Austin Wright, general secretary. He will be glad to have with him for part or all of the journey any officers or members of the Institute who can see their way clear to make the trip. It is always appreciated by branches when the president includes in his party members of other branches. It is realized, of course, that the congestion associated with travelling at the present time may make it unusually difficult for persons to join the party.

PROPOSED ITINERARY

MONTREAL	*Lv.*	Monday	April 9th	7.30 p.m.
SYDNEY	*Arr.*	Wednesday	April 11th	7.30 a.m.
Branch Meeting—April 11th				
SYDNEY	*Lv.*	Thursday	April 12th	6.30 a.m.
(If by motor—stopping at Antigonish to meet the students at St. Francis-Xavier University)				
HALIFAX	*Arr.*	Thursday	April 12th	7.00 p.m.
Branch Meeting—Friday—April 13th				
Meeting with Students at Nova Scotia Technical College—April 13th				
HALIFAX	*Lv.*	Monday	April 16th	By motor
Meeting with Students at Acadia University, Wolfville				
HALIFAX	*Arr.*	Monday	April 16th	By motor
HALIFAX	*Lv.*	Tuesday	April 17th	7.15 a.m.
SACKVILLE	*Arr.*	Tuesday	April 17th	11.58 a.m.
Meeting with Students at Mount Allison University				
SACKVILLE	*Lv.*	Tuesday	April 17th	By motor
MONCTON	*Lv.*	Tuesday	April 17th	5.05 p.m.
SAINT JOHN	*Arr.*	Tuesday	April 17th	8.00 p.m.
Branch Meeting—Wednesday—April 18th				
SAINT JOHN	*Lv.*	Thursday	April 19th	By motor
FREDERICTON	*Arr.*	Thursday	April 19th	
Meeting with Students at University of New Brunswick				
FREDERICTON	*Lv.*	Thursday	April 19th	By motor
SAINT JOHN	*Arr.*	Thursday	April 19th	
SAINT JOHN	*Lv.*	Friday	April 20th	10.30 a.m.
MONCTON	*Arr.*	Friday	April 20th	1.15 p.m.
Branch Dinner Meeting—April 20th				
Regional Council Meeting—April 21st				
MONCTON	*Lv.*	Sunday	April 22nd	2.10 a.m.
MONTREAL	*Arr.*	Sunday	April 22nd	9.20 p.m.

TO JUNIORS AND STUDENTS IN QUEBEC

Juniors and Students of the Institute residing in the province of Quebec who belong to the Corporation of Professional Engineers are reminded that they may, *until April 21st*, transfer to a higher class of membership in the Institute without having to pay the transfer fee. This is a result of the co-operative agreement entered into, on January 21st, by the Institute and the Corporation. The privilege expires after 90 days from the date of the signing.

The transfer fee, usually required, is as follows:

From Student to Junior	$ 5.00
From Junior to Member	5.00
From Student to Member	10.00

Under the provisions of the agreement, Students and Juniors who belong to the Corporation may become full Members of the Institute, notwithstanding the other requirements of the by-laws, provided they apply within the prescribed time.

The necessary application forms have been sent to those who qualify for this privilege and, no doubt, the majority will want to take advantage of it.

CO-OPERATION ABROAD

The Institute has always enjoyed excellent relationship with British Institutions. While the war has retarded certain developments along this line, it has expanded others. For instance, the exchange of membership privileges on a complimentary basis, whereby Canadians in the Old Country were welcomed by the headquarters of British Institutions, and their members in Canada were put temporarily on the membership lists of the appropriate branch of the Institute in Canada, has done much to improve the contacts between individuals, and maintain the warm relationship between societies.

A further proposal for exchange of benefits has just been made, whereby the publications of the Institution of Electrical Engineers are made available to members of the Institute at one-half the regular price charged non-members. The Council of the Institute has accepted this proposal heartily and is glad to extend similar privileges to members of the Institution.

So that members may take advantage of this offer, the following information on the British publications is provided:

The Journal

Issued in three parts annually. Part I (General) contains all material of general interest together with abstracts of all the papers accepted for publication in full in the other two parts. Each of these abstracts is designed to bring out the main points of the paper concerned for the benefit of those readers who have no specialized knowledge of the subject dealt with.

Papers appear in full, together with the discussions on them, in the other two parts, (Part II "Power Engineering" and Part III "Radio and Communication Engineering").

The contents of the various parts are as follows:

Part I "General"

(Volume commences in January. 12 monthly numbers)
Addresses and Lectures of a general character
Abstracts of all Papers in Parts II and III
Progress Reviews
Formal Proceedings of The Institution
"Institution Notes"

Obituary Notices
Council's Report
Accounts, etc.

Part II "Power Engineering"

(Issued every other month. Volume commences in February)
Power Generation, Transmission and Distribution
Power Applications
Meters and Instruments
Design of Machinery and Testing
Formal Proceedings of the Installations, Measurement and Transmission Sections

Part III "Radio and Communication Engineering"

(Volume commences in March. Four quarterly numbers)
Radio and Television
Telegraphy and Telephony
Formal Proceedings of the Radio Section

Obtainable by members of The Engineering Institute of Canada, if ordered in advance, at the following special subscription rates:

Part I	10s. 6d. per annum, post free	All three parts:- £1 11s. 6d. per annum, post free
Part II	15s. 9d. per annum, post free	
Part III	10s. 6d. per annum, post free	

(List price is £3 2s. 0d.)

Payments should be made through The Engineering Institute of Canada.

As new volumes commence in January it would be helpful if prospective subscribers would indicate their interest immediately.

The Institute is pleased and gratified that this splendid British Institution has taken the initiative in promoting an extension of co-operation. It appreciates and is grateful for the sentiment expressed by the Council of the Institute in its communication, as manifested in these quotations taken from it.

"The Council would like you to regard this offer as calculated to knit together still more closely sister Institutions which have in common the advancement of engineering science for the welfare of mankind."

"It is clear that the foregoing does no more than represent an earnest of the fuller interworking which we hope in time to bring about, but I feel it will be necessary to await the opportunity of an informal conference at first hand before the steps that will be required to put the policy more fully into being can be decided; a pleasure which must clearly await some amelioration of the conditions in which we find ourselves at present."

OMISSION

Toronto Branch Annual Report

It has been brought to the attention of the Editor that the most important function in the list of activities of the Toronto Branch for the year 1944 was omitted from the report submitted for publication on page 98 of the February issue of the *Journal*.

In order to complete the record the following should be inserted in the report:

June 16—The Toronto Branch was honoured by having President and Mrs. de Gaspé Beaubien as guests for dinner at the Royal Canadian Yacht Club. The president addressed those assembled on the subject of the part the engineer should play in social affairs. The general secretary spoke briefly on the highlights of the work of the Institute. R. E. Heartz commented on the problems involved in collective bargaining from the point of view of the engineer.

THE STUDENTS ARE SELDOM WRONG

The following delightful "appreciation" of the new president is taken from the special Convention Issue of the "*Slide Rule*" published by the engineering and architectural societies of the University of Manitoba, to coincide with the annual meeting of the Institute. So many members attending the meeting enjoyed the sketch that the *Journal* felt it should be made available to all members. It gives the students' appraisal of a man, and in such things the students are seldom wrong.

The Dean...An Appreciation

University is not a place of bricks and mortar, of lordly buildings and spacious grounds. Without men, these are less than nothing. Dean Fetherstonhaugh is one of those men who make a University. There is something of the classical about him—a touch of old-fashioned dignity in the clean-cut suit, the starched collar a size too large, the neatly knotted tie. The tall, stooped figure of the Dean has passed through the halls of the various Engineering buildings, from office to library, from draughting room to laboratory during thirty-odd sessions. To-day, his carriage is reminiscent of the fine soldier who was awarded the Military Cross in World War I. His bearing, modest and courtly, is that of the scholar and gentleman.

The Dean's contributions to the University of Manitoba in the organization and development of a Faculty of Engineering much along the lines of his Alma Mater, McGill University, are too well known to need mention here. His efforts on behalf of Canadian science during the years he has served as a Member of the National Research Council of Canada, have been untiring. Recognition of Dean Fethersonhaugh's splendid qualities of judgment and leadership has come in the form of his nomination as President-elect of The Engineering Institute of Canada—the highest honour of its kind that may be given a member of the Engineering profession in Canada.

Students who see the Dean first as a teacher and disciplinarian — a man with a reserve and austerity that convey an impression of unapproachability—are surprised to learn, on better acquaintance, that he has a sharp sense of humour, often coupled with a dry wit directed at himself. His laugh is short and is followed by a series of chuckles that leave his keen eyes sparkling and smiling. Students find in the Dean a mentor and counsellor who is willing to help them with their problems, never sparing his time and energy in making certain that all traces of doubt and confusion as to the solution are removed from their minds. Repeating his services to the veterans who returned to the University of Manitoba after the last war, the Dean has already given to the men, now coming back to University studies under the Veterans' Welfare Act, the benefit of his guidance and encouragement.

The Dean's many friends, both in and outside of the engineering profession, are impressed by his loyalty and sincerity. At a recent meeting the present President of The Engineering Institute of Canada, M. de Gaspé Beaubien, speaking before the students of the Faculty, paid his respects to his "dear friend, Fethers," saying that rarely had a man with "so soft and velvety a hand" come so far on the road to success. Here, in the very simplest of words, was expressed the admiration of one great man for another.

In private life, Dean Fetherstonhaugh is a keen golfer, a wide reader, particularly in the field of history, a lover of good music, and an artist with water colours.

He enjoys a privilege seldom given to Canadians—that of being a Fellow in the Royal Society of Arts.

In these few words we, the students of Engineering and Architecture, have tried to express a small part of that respect and admiration we feel for Dean Fetherstonhaugh. Of him it can be truly said,

> "*And thus he bore without abuse,*
> *The grand old name of gentleman.*"

WASHINGTON LETTER

Results of the Crimea Conference

The results of the Crimea conference at Yalta have been received with almost universal approbation. A substantial degree of unanimity has been reached on a number of points which prior to the conference were causing grave concern. There are good indications that a better understanding and increased cooperation will characterize relations with Russia. There was a full appreciation of the necessity of finding ways in which the economies of the United Kingdom and the United States can be made to work in with the Russian economy. The extremely strong position which Russia will occupy after the war was fully recognized and taken into account at the conference.

It is generally agreed that solutions for the problems of international security and international finance are of the utmost importance before the general groundwork can be laid for postwar plans either nationally or internationally. It would appear that considerable progress was made at the Crimea conference on both these problems. One of the first actions of President Roosevelt following the conference was an urgent call for immediate Congressional action on the Bretton Woods agreements. Coupled with the President's call was his own outline for a major programme for postwar economics. He called for an extension and a broadening of the Trade Agreements Acts; he expressed himself in favour of the reduction of trade barriers; he called for the establishment of a United Nations organization to deal with the problems of food and agriculture; he cited the need for the control of cartels and a general agreement covering the disposal of world surpluses; the Export-Import Bank will probably have its activities extended; further conferences are envisaged on specific subjects such as petroleum, civil aviation, shipping and communications.

Also immediately following the conference, machinery has been put in motion for the Security Conference which is to take place at San Francisco next April. The President is making every effort to ensure successful American participation, and a strong bi-partisan American delegation under the chairmanship of Secretary Stettinius has been named. The delegation includes Cordell Hull, Senators Vandenburg and Connally, Representatives Eaton and Sol Bloom, Dean Virginia Gildersleeve of Barnard and Commander Harold Stassen, former Governor of Minnesota.

The 60-hour World

As this is being written, the Inter-American Conference on War and Peace is being convened in Mexico City. This conference has been called by the Pan-American Union. The much travelled Secretary of State Stettinius arrived at the conference by plane from Brazil on his way back from the Yalta meeting. As confirmed at the Yalta meeting, the first meeting between the three Secretaries of State is scheduled to take place in London shortly after the San Francisco conference. The Reparations Commission which was also established at Yalta is to have Moscow as its headquarters. Also as this is written, the UNNRA conference is taking place in Australia. The way in which history and geography have become combined in recent years is symptomatic. Casablanca, Washington, Teheran, Quebec, Yalta, Montreal, Hot Springs, Chicago, Atlantic City, Mexico City, Bretton Woods, all conjure up important mileposts in the progress of the war and in the growing understanding and cooperation of the peoples of the world. This is part of a new trend in the conduct of human affairs which is only partly due to the fact that we are living in what is coming to be known as the "60-hour world".

Of particular interest to engineers is a recent British proposal for the construction of a 200-mile canal through Palestine, linking Acre with the Red Sea and passing through the Dead Sea. This proposal arises from the fact that the present Suez canal is inadequate for modern traffic purposes and that it reverts to Egypt in 1968. The proposed canal would be a tremendous undertaking, especially when one takes into account the fact that the Dead Sea is over 1,000 ft. below sea level.

Secretary of the Interior Ickes has recently written to the President making a bid for the postwar job of developing the water and power projects of the Nation. Secretary Ickes envisages a coordinated plan for harnessing the country's waterways in an ocean-to-ocean conservation scheme. He admits that the plan is a herculean one but he sees it as the nearest economic equivalent to war in the field of conservation. He stresses the necessity for regional development in its boldest outlines. He adds: "The programme must embrace entire areas, usually the basins of great rivers and their tributaries; it must provide for full and unified development of all of the resources within the region, and an ideal programme would call for simultaneous attack upon all phases of the job."

U.K.-U.S. Exchanges

Mr. William L. Batt, vice-chairman of the War Production Board and joint chairman of the Combined Raw Materials Board is also an honorary member of The Engineering Institute of Canada. Ever since the Keynes-Morgenthau discussions, the difficulties of the United Kingdom financial and trading position and the inter-dependence of the interests of the United States and the United Kingdom have been increasingly widely discussed. Mr. Batt has recently made an important speech on this subject in which he brings his engineering experience to bear. A member also of the Combined Production and Resources Board, he has been in close touch with the problem of improving manufacturing methods and effecting an interchange of technical experience. He cites two of England's most important exporting industries, textiles and coal, and compares English and American manufacturing practices in these two industries to the detriment of the United Kingdom. There is little gainsaying Mr. Batt on the two examples he has chosen. Recent U.K. missions in this country have admitted that England can profit greatly by what they have learned in this country. Mr. Batt might, however, have placed more emphasis on the two-way nature of such exchanges. The United States may have a better understanding of mass production techniques but England excels in quality production and understands the limitations of mass production. Despite a tremendous development in American shipbuilding practice, British costs are still very much lower than American costs. While it is true that the mass production of penicillin was developed in America, the discovery of penicillin itself was made in the United Kingdom. By all means let us have an increase in exchanges and a pooling of ideas and resources and technicians. But let us lay stress on the two-way nature of the benefits.

* * *

German rocket bombs have fallen recently on the ancient city of Canterbury. The resulting deep craters have uncovered archaeological evidence carrying the history of even that storied city farther back into antiquity than had ever before been suspected. By comparison, the Roman and Saxon settlements on the banks of the Stour river, on the track subsequently to be known as the Pilgrim's Way, are comparatively modern. So explodes the weapon and the myth of a thousand years of Nazi domination.

E. R. Jacobsen, m.e.i.c.

February 22nd, 1945,
Washington, D.C.

POLISH ENGINEERS ELECT OFFICERS

A luncheon and meeting of the Association of Polish Engineers of Canada was held in the Windsor Hotel, Montreal, on February 18th, 1945, for the purpose of electing new officers and councillors for the year 1945. The following were elected:

President..........J. S. Korwin-Gosiewski, m.e., e.e.
First Vice-President.............Z. Zolkiewicz, c.e.
Second Vice-President...........R. Sulatycki, m.e.
Councillors.....................S. Nycz, m.e.
W. Brzozowski, m.e.
Z. Krzesz, ch.e.
General Secretary...............S. Jurczowski

The officers for the Montreal Branch are as follows:

Chairman.......................Z. Zolkiewicz, c.e.
Councillors....................E. Hospodarewski
M. Itelson-Ralski
B. Przasnyski
J. Jodlowski
T. Biernacki

The officers for the Toronto Branch are as follows:

Chairman......................R. Sultatycki
Councillors...................W. Malczewski
L. Seuer
S. Sabiszewski
E. Baronowski

The luncheon was presided over by J. S. Korwin-Gosiewski, and at head table there were the following guests:

W. Babinski of Ottawa;
T. Brzezinski of Montreal, Consul General of Poland;
I. S. Patterson, of Ottawa, Wartime Bureau of Technical Personnel;
G. H. Burdett, of Montreal, Wartime Bureau of Technical Personnel;
R. Herget, of Ottawa, Wartime Bureau of Technical Personnel;
J. C. McGowan, of Montreal, Director of Immigration, C.N.R.;
G. A. Gardiner, Director, C.N.R.;
J. Wroblewski, of Montreal, Chairman of the Canadian Relief Committee;
L. Austin Wright, General Secretary of The Engineering Institute of Canada;
C. C. Lindsay, President of the Corporation of Professional Engineers of Quebec;
H. Harajewicz, of Ottawa, Secretary of the Polish Legation;
Armand Circé, of the Ecole Polytechnique, Montreal.

CORRESPONDENCE

The Architect and the Organist

40 Lorne Ave.,
St. Lambert, Que.
March 1, 1945.

The Editor,
The Engineering Journal

Sir,

The engineers have been beaten by the architects, and beaten with the rods that the engineer has been pickling for the past forty years.

When an architect draws up a building with a steel framework, does he work out the stresses ? No, he sends his drawings to a bridge company, and an engineer makes calculations free of charge (to the architect). When an architect desires to use concrete, does he figure "resisting moments" ? No, he passes the responsibility on to an engineer employed by a reinforcing company, and this engineer also makes no charge for his services (to the architect) and the same thing is done with plumbing, water supply, ventilation, heating, mechanical equipment, in fact, with every up to date material or device that goes into a modern building.

Do not blame the architect for his attitude. The engineer has sat in the background, done his work and allowed him to become obsessed with the idea that he is the sole co-ordinating agent in the design and construction of buildings. One can forgive him his feelings of omniscience, but at the same time feel that he should not have "bit the hand that fed him" (literally and metaphorically). The architects' mode of thinking is even more self-important than the village youth who pumped the church organ, and was heard to remark to the organist, "We made a pretty good job of the music this morning, didn't we ?"

Yours sincerely,
(*Signed*) C. D. Norton, m.e.i.c.

MEETINGS OF COUNCIL

The annual meeting of the Council of the Institute was held at the Royal Alexandra Hotel, Winnipeg, on Tuesday, February 6th, 1945, convening at ten thirty a.m.

Present: President de Gaspé Beaubien (Montreal) in the chair; Past-President K. M. Cameron (Ottawa); Vice-Presidents W. P. Brereton (Winnipeg), G. L. Dickson (Moncton), J. M. Fleming (Port Arthur), L. F. Grant (Kingston), and C. K. McLeod (Montreal); Councillors J. E. Armstrong (Montreal), H. E. Brandon (Toronto), H. L. Briggs (Winnipeg), R. S. Eadie (Montreal), E. V. Gage (Montreal), P. E. Gagnon (Quebec), R. E. Heartz (Montreal), A. Jackson (Kingston), A. Love (Hamilton), E. B. Martin (Moncton), A. W. F. McQueen (Niagara Falls), P. M. Sauder (Alberta Assn.), C. Stenbol (Sault Ste. Marie), E. O. Turner (New Brunswick Assn.), J. A. Vance (Woodstock), H. J. Ward (Shawinigan Falls); President-Elect E. P. Fetherstonhaugh (Winnipeg); Vice-Presidents-Elect C. E. Sisson (Toronto) and R. A. Spencer (Saskatoon); Councillors-Elect C. W. Carry (Edmonton), R. B. Chandler (Port Arthur), J. McD. Patton (Regina), and W. L. Saunders (Ottawa); Treasurer R. E. Chadwick (Montreal); General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

The following were also present by invitation—Past-President S. G. Porter (Calgary), Past Vice-President E. V. Caton (Winnipeg), Past-Councillor N. M. Hall (Winnipeg); J. B. Stirling, chairman, and G. A. Gaherty, a member of the Committee on Professional Interests; J. G. Hall, chairman of the Membership Committee and a past councillor; Stewart Young (Regina), registrar of the Association of Professional Engineers of Saskatchewan, and a past councillor of the Institute; S. H. deJong, secretary of the Toronto Branch; H. B. LeBourveau, chairman of the Calgary Branch; C. P. Haltalin, vice-chairman, and T. E. Storey, secretary of the Winnipeg Branch, and J. W. MacDonald of Windsor, Nova Scotia, representing the Halifax Branch.

In welcoming the councillors and guests, President Beaubien expressed his gratification at seeing so many members who had come from distant parts of the country. Unfortunately, the trains from the east were late and several members of Council would not arrive in time for the morning session. He suggested that several items on the agenda, on which there would undoubtedly be considerable discussion, be held over until the afternoon. Agreed.

Following the usual custom, there was a roll call and the president extended a cordial invitation to guests to take part in all discussions.

Rehabilitation of Members in the Armed Forces—Recently the Council had decided to set up a committee to establish the policy of the Institute in regard to the rehabilitation of members in the active services and of members transferring from peace-time to war-time activities. The selection of the chairman had been left with the president and Mr. Beaubien announced that Major-General Howard Kennedy, Montreal, now demobilized, had accepted the chairmanship. In order to cover the field fully, General Kennedy was planning to have with him on the committee a high ranking Navy man, and a member of the Air Force, also industrialists and employers of engineers. This appointment was noted and unanimously approved.

Community Planning—The general secretary reported that a letter had been received from Mr. Forsey Page, president of The Royal Architectural Institute of Canada (R.A.I.C.), agreeing with the suggestions which had been made previously that the R.A.I.C. and the Engineering Institute should get together to assist in establishing a national organization concerned primarily with community planning.

In the discussions which followed contributions were made by Messrs. Vance, Young and the president, it being emphasized particularly by Mr. Young that in re-organizing the former Town Planning Institute, or in establishing a new organization, care should be taken that the membership was not restricted to a professional group. He pointed out that because of the many groups of persons who were interested in the subject it should be possible to arrange that all of them might become members of equal standing in such an organization. Mr. Young moved that the Engineering Institute join with the R.A.I.C. for the purpose of fostering community planning interests. This was seconded by Mr. Vance, and approved unanimously, it being left with the president to select the Institute's representatives on the proposed committee.

The general secretary reported that in conversations with Mr. John Galbraith, who was giving a paper during the annual meeting on the subject of community planning, Mr. Galbraith had suggested that it would be helpful if the Institute's approval of taking part in this activity were recorded in the form of a motion. Accordingly, the general secretary presented the following motion:

RESOLVED that this session of the annual meeting of The Engineering Institute of Canada held in Winnipeg on February 7th, 1945, wishes to place itself on record as acknowledging the responsibility of the profession and the Institute in the vital subject of community planning. It recommends that the Council of the Institute establish immediately a committee to develop and administer a programme of activities whereby the Institute may make the maximum contribution to the solution of the many problems present in all parts of Canada. This programme should include encouragement and support of a planning institute at the national level, development of interest in local problems by each branch, and publicity on a local and national basis that will inform the public as to what is in its best interest, and of the engineer's concern for its welfare.

This resolution was approved by Council and it was moved by Mr. Armstrong that it be brought forward at the annual business meeting of the Institute the following morning. This was seconded by Mr. Patton and carried unanimously.

Co-Operative Agreement in Quebec—The general secretary reported that the co-operative agreement between the Institute and the Corporation of Professional Engineers of Quebec had been signed at Institute Headquarters on January 20th. Letters were being sent out to those members who do not at present belong to both bodies urging them to take advantage of the terms of the agreement and apply immediately for membership in the other body.

On the motion of Mr. Eadie, seconded by Mr. McLeod, it was unanimously resolved that the president be authorized to name the three representatives of the Institute on the committee called for in clause 9 of the agreement.

Engineer in the Active Services—The general secretary reported that since the question of the appointment of a chief engineer to a senior rank such as Brigadier or Major-General in the Army organization had been discussed by Council he had had conversations with certain Ottawa officials and they were all of the opinion that the Institute should make a strong endeavour to have such an appointment made that would be comparable to that in the Army Medical Corps, but that in view of the political situation no further action should be taken at the moment.

Colonel Grant, a member of the Institute's committee, made a comparison between the status of the engineer in the Canadian Army and in the United States Army. He thought that attempts should continue to be made to secure for the engineer in the Canadian Army the same high status that he enjoys in the United States Army. He was definitely of the opinion that the Institute should press for this improved recognition, but he also agreed that little could be done until the political situation was clarified.

Canadian Standards Association: On the motion of Mr. Sauder, seconded by Mr. McLeod, it was unanimously resolved that Dr. P. L. Pratley be nominated as the Institute's representative on the Main Committee of the Canadian Standards Association for a three year period commencing on April 1st, 1945.

Association Representation on Council: It was noted that Professor E. O. Turner, of Fredericton, had been appointed as the representative of the Association of Professional Engineers of New Brunswick on the Council of the Institute for the year 1945.

Co-operation with British Institution of Engineering: The general secretary presented a letter from the secretary of the Institution of Electrical Engineers which reads in part as follows:

"When in communication with you towards the end of March last year, I said that I hoped before long to write to you in more detail on the subject of co-operation between our Institutions. In the intervening months this desire has been very much to the fore in the deliberations of my Council and those Committees which are concerned with these matters. Though the continuation of the war in Europe and the necessary restrictions which it brings in its train have prevented a fuller development of the interchanges which we both desire, I can now put forward one small step towards our closer co-operation."

"The Council have decided that members of sister Institutions overseas with whom The Institution has reciprocal arrangements for the exchange of visiting membership facilities, should be given the opportunity of obtaining copies of The Institution Journal and 'Science Abstracts' at the special reduced subscription rate, one-half of the price charged to the public."

"The Council would like you to regard this offer as calculated to knit together still more closely sister Institutions which have in common the advancement of engineering science for the welfare of mankind."

"It is clear that the foregoing does no more than represent an earnest of the fuller interworking which we hope in time to bring about, but I feel it will be necessary to await the opportunity of an informal conference at first hand before the steps that will be required to put the policy more fully into being can be decided; a pleasure which must clearly await some amelioration of the conditions in which we find ourselves at present."

Mr. McLeod expressed his pleasure at this further demonstration of co-operation with the British institutions. He moved that the offer be accepted immediately, and that the Institute extend similar privileges with regard to *The Engineering Journal.* This was seconded by Mr. Dickson and carried unanimously.

A.S.C.E. Honorary Membership: It was noted with gratification that at the recent annual meeting of the American Society of Civil Engineers, Dr. Arthur Surveyer, a past-president of the Institute, had been elected to honorary membership. There are now three past-presidents of the Institute who have been so honoured, Past-Presidents G. H. Duggan and J. M. R. Fairbairn having received a similar recognition on previous occasions. Council instructed the general secretary, on behalf of Council, to acknowledge to Dr. Surveyer the honour which had been done him.

National Construction Council of Canada: Some time ago the general secretary had been instructed to ask Mr. D. C. Tennant, the Institute's representative on the National Construction Council, for a review of progress made by the Council. Mr. Tennant also represents the Institute on the Toronto Reconstruction Council and on the Rehabilitation Committee, Department of Pensions and National Health.

The general secretary read a letter just received from Mr. Tennant giving a summary of the activities of these three organizations, and he was directed to refer the letter to the Institute's Committee on Professional Interests for consideration.

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

Saskatchewan (as of Jan. 18th, 1945):

Member—G. B. Alexander;

Student to Junior—D. Cramer;

Students—B. N. Burwell, J. L. Cook, G. A. Duey, W. H. Harper, A. Mowchenko, M. Nicolson, K. S. Sargent.

New Brunswick:

Junior to Member—Y. Nadeau.

Consideration of Quebec Applications: In view of the co-operative agreement now effective between the Institute and the Corporation of Professional Engineers of Quebec, it was unanimously agreed that J. B. Stirling, R. S. Eadie and J. A. Lalonde be appointed a committee to discuss with the Corporation routines and procedures to be followed for applications for admission to the Institute from persons residing in the province of Quebec.

The Council adjourned for lunch at one fifteen p.m., and reconvened at two forty-five p.m. with the president in the chair.

Death of Harry F. Bennett: The president reported that he had been informed of the sudden death of Harry F. Bennett, in London, Ontario, on January 31st. He knew that this would be a serious blow to many people in the Institute and that it would be almost impossible to replace him in the activities in which he had given leadership.

Many councillors expressed deep regret at this sad news and all agreed on the seriousness of the loss to the Institute. It was proposed and unanimously resolved that a message be sent to Mrs. Bennett and that Council record in the minutes of this meeting its sense of great loss. Accordingly, the following minute was approved:

> The Council of The Engineering Institute of Canada has been shocked to learn the tragic news of the death of Harry F. Bennett, at London, Ontario, on January 31st, 1945, and desires to record in the minutes of this meeting some indication of its appreciation of the loyal and intelligent service which he has rendered the Institute and the profession, and also to convey to his wife and other relatives its sympathy in the great loss which they have suffered.
>
> Few engineers have been as unselfishly interested in the welfare of the profession, particularly its younger members, as has been Harry Bennett, and few have devoted as much time and energy to that cause. His patient, kindly, intelligent leadership in such matters has encouraged hundreds of other engineers to join with him to raise the levels of the profession, and through this extended effort hundreds more of young engineers and prospective engineers have been given vital guidance and counsel that otherwise would not have been available to them. The monuments to his great work and to his personality are spread from coast to coast in the minds and hearts of those who knew him.
>
> In an endeavour to extend into the future the effects of some of the things that he worked on so earnestly in the past, and to perpetuate his name in the annals of the Institute, Council proposes to establish immediately a prize for young men to be known as the Harry F. Bennett Prize.
>
> Council speaks for all the members of the Institute in extending to Mrs. Bennett its most sincere sympathy. The loss which is so personal to her is shared to a lesser degree but still poignantly by all those engineers who were privileged to know him. He will be greatly missed in our midst.

Employment Conditions (Collective Bargaining)—The chairman of the Committee on Employment Conditions, R. E. Heartz, stated that a report of his committee was included in the annual report of Council for the year 1944. As the report was too long to present in detail he recommended that it be read in the annual report. He observed that the brief and the questionnaire issued last July still seemed to be quite sound and to cover the purposes reasonably well. He thought it was still used by many people as the basis from which to start their thinking.

He reported that twenty different engineering organizations had been represented by the sub-committee of three which, on January 9th, had appeared before the Wartime Labour Relations Board in Ottawa. He explained the position of the trade union organizations and their opposition to the request of the professional societies for a new order. He pointed out that the brief presented by the sub-committee to the Board was printed in full in the January *Journal* and that further details would be given in the February *Journal*.

The president thought that Council was greatly indebted to Mr. Heartz for the excellent work which he had done for the Institute. He also expressed appreciation of Mr. Heartz' employers who had made it possible for him to devote so much of his time to the work. It was moved by Mr. McLeod, seconded by Mr. Dickson, and carried unanimously, that Mr. Heartz' progress report be accepted.

Statement on Relations with Sister Societies—Mr. Stirling, chairman of the Committee on Professional Interests, reviewed the situation that had been created a few months ago by a further endeavour to form a new overall engineering body. He outlined the history of the movement up to the time that a proposal was submitted to the Council of the Institute at Edmonton in October 1944. At that meeting Council had considered the proposal and had referred it to the Committee on Professional Interests with instructions to consult the provincial professional associations with which the Institute had co-operative agreements.

Mr. Stirling stated that his committee had met several times and that members from Nova Scotia, Quebec and Ontario had been present. From these meetings had emerged a document known as a "Statement of Principles and Policy of the Institute on Relations with Sister Societies." At the December meeting of Council it was agreed that the president would send this statement to all past-presidents, to vice-presidents and to councillors, asking for an expression of opinion, and that the chairman of the committee would send it to the associations with which the Institute had agreements, asking for approval, criticisms or suggestions.

Mr. Stirling now reported that a great number of replies had been received which he felt need not be presented in detail at this meeting. All replies, in general, endorsed the statement of policy. In view of the far-reaching effects of this statement, and the fact that some opinions had not yet been received, Mr. Stirling presented the following resolution which was moved by Mr. Armstrong and seconded by Mr. Vance:

> WHEREAS the Committee on Professional Interests on December 16th, 1944, submitted to Council a draft of a proposed declaration of principles defining the relations of the Institute with other engineering societies—Canadian, British and American; and
>
> WHEREAS, by direction of Council, the president has requested the past-presidents and the members of council to consider and pass upon this draft; and
>
> WHEREAS, by direction of Council, the chairman of the Committee has requested the opinions of the presidents and secretaries of the five provincial associations having agreements with the Institute; and
>
> WHEREAS all the past-presidents and all the councillors who have been heard from endorse the draft; and
>
> WHEREAS the officers of the Quebec Corporation and the New Brunswick Association endorse the draft unqualifiedly, the Saskatchewan Association suggests an amendment that does not affect the principle, and the Councils of the Alberta and Nova Scotia Associations have recorded certain reservations; and
>
> WHEREAS the formulation of a generally acceptable long-term programme of co-operation with other engineering bodies is of great importance to the Institute and to the engineering profession in general, it is imperative that the draft be most carefully considered; and
>
> WHEREAS the Committee on Professional Interests not having had an opportunity adequately to appraise the various opinions which, although preponderantly favourable to the draft, do vary in certain particulars;
>
> THEREFORE the Committee on Professional Interests recommends that it now be instructed by Council
>
> (a) to confer further with such individuals or associations as have indicated reservations; and
>
> (b) as soon as practicable to formulate a final recommendation for submission to Council.

Dr. Gagnon inquired as to the relationship between this resolution and the Canadian Council of Engineers and Scientists which he believed had already been organized. He would like to know if the Institute statement indicated the intention of establishing a co-operative organization consisting only of *professional engineering* organizations in addition to the Canadian Council which was made up of engineers, non-engineers and members of other professions such as architects and chemists.

In reply Mr. Stirling explained that it was the discussion which had developed because of the proposal to establish the Canadian Council of Engineers and Scientists that had caused this statement to be prepared. The committee had thought that before the Institute took any action on the new proposal, the whole situation should be reviewed in relationship to the already established policy of the Institute and its broad interest in and prime concern for co-operation with *professional engineering* organizations.

Mr. Stirling explained further that the Committee on Professional Interests agreed that the Institute should proceed one step at a time, and, first of all, find out if the membership was agreeable to co-operating with strictly professional engineering societies, and then determine if it was agreeable to co-operating with organizations representing other professions, and in many instances, non-professional people as well. His committee believed that it would clarify the thinking if straightforward principles were agreed upon first.

Mr. Young thought that clause E of the statement covered the situation, and in response to his suggestion Mr. Stirling read the clause as follows:

> "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."

At this point the president presented an outline of the history of the various movements which had brought engineers in Canada up to the present situation. He referred to the proposals made last fall at the meetings of the fourteen societies in Ottawa relative to a new society. He pointed out that at those meetings it had not been clearly indicated just what such a new organization could do that was not already being done. At one meeting, when a very full discussion took place, it appeared to be the opinion of the majority that the proposal was not well supported and therefore, at the suggestion of the proposer, it was withdrawn. However, at the next meeting it was brought up again in a somewhat new form, and as there had been no opportunity to have an expression of opinion on the new proposal from the Council of the Institute, it was not possible for the Institute's representatives to express any opinion. However, the majority at that meeting had voted in favour of it, and it was this proposal which had prompted the Institute's committee to prepare a statement of principles.

Dr. Turner inquired as to the progress which had been made in forming the new council. The Association of Professional Engineers of New Brunswick had read in a bulletin of one of the associations that the new council had been formed. No specific inquiry or information had been sent to the N.B. Association but it had been agreed by the officers of that organization that the matter was of considerable concern to them and that developments should be watched closely particularly from the financial point of view.

In reply to Dr. Turner's inquiry, Mr. Stirling expressed his opinion that the position of this new development was rather confused, because several of the provincial associations and others had opposed the proposal. As far as finances were concerned, he had nothing definite to report inasmuch as the Institute had not been represented at the first meeting and therefore had not received a copy of the minutes, but he had been told informally that it was agreed that there would be an assessment of ten cents per member on all organizations participating.

Mr. Young stated that in Saskatchewan the Association was opposed almost one hundred per cent to this new set-up. In his opinion there were too many engineering organizations now.

Mr. Patton, supporting Mr. Young, stated that the Saskatchewan Association did not support the proposal. The Association had approved of the Institute's statement of principles but had suggested an amendment to clause E whereby the presidents of the various organizations would be able to take action in times of emergency. That was as far as his Association wanted to go.

Dr. Gagnon stated that he had understood that the new organization was simply an attempt to put in permanent form the committee of fourteen which had been brought together to discuss collective bargaining.

In reply, Mr. Stirling expressed the opinion that Dr. Gagnon had misunderstood the situation. It was not the opinion of the Institute Council that the new organization was only a continuation of the committee of fourteen, in that it had or would supplant that committee.

Mr. Muntz was of the opinion that every endeavour should be made to promote co-operation between societies. He thought, however, that in view of the many things that had to be kept in mind, Mr. Stirling and his committee would be quite able to handle the situation satisfactorily from the point of view of the members of the Institute.

At this point the motion was put to the meeting and carried uanimously.

Automatic Transfer of Students and Juniors—Mr. Hall, chairman of the Membership Committee, reported at length on a proposal which had been before Council previously and which had emanated originally from the Peterborough Branch. The matter had been discussed in some detail by Councillor Sills of the Peterborough Branch at the December meeting, at which time the subject was referred to the Membership Committee for report at the annual meeting of Council.

In the discussion which followed, Mr. Hall stressed the desirability of establishing an Admissions Committee which would examine all applications for membership and transfer and report to Council. In this way Mr. Hall believed that much of Council's time could be saved, and that a better examination of the applicant's qualifications could be obtained.

Mr. Armstrong questioned the desirability of eliminating transfer fees inasmuch as considerable time was now being spent by the Finance Committee in considering means by which income from fees could be increased.

In reply, Mr. Hall was of the opinion that the saving in time and expense at Headquarters in following up of overage Students and Juniors, and the increase in revenue due to prompt transfers would more than offset the loss from transfer fees. He pointed out that you could not transfer a person automatically if you insisted on a transfer fee. He also pointed out that in the medical and legal professions a person becomes a full member and does not have to pass through junior or other classifications first. At this point Mr. Hall asked for the opinions of councillors on the other points raised in his report, namely,

1. The elimination of Junior membership.
2. The appointment of an Admissions Committee.
3. Emphasis on the responsibility of branch membership committees.

Mr. Cameron agreed with the necessity of impressing upon the branch membership committee its responsibility. Such committees were made up of hard-working members in each branch, and he suggested that the proposals of Mr. Hall's committee might be submitted to the membership committee in each branch, as they were in an excellent position to discuss such subjects.

It was agreed that Mr. Hall's report be accepted as an interim report and that a revised edition would be prepared for publication in the *Journal* and presentation to the branches.

Engineers and the Design of Buildings—The general secretary outlined the most recent developments in the case of the Province of Quebec Association of Architects vs. Brian R. Perry, stating that in the opinion of the judge who had heard the case Mr. Perry had contravened the Architects' Act and therefore was guilty of the charge made by the association. Notice of appeal had been filed almost immediately. In Mr. Wright's opinion the judgment was not well founded. He explained that he had examined the evidence, the argument and the judgment, and agreed firmly with Mr. Perry and his counsel that there was good ground for appeal. He also reported that a meeting had been held at the Institute at which were present officers of the Corporation of Professional Engineers of Quebec and the Institute, as well as legal counsel and Mr. Perry. At this meeting the situation was reviewed in considerable detail and encouragement was given to Mr. Perry to proceed with the appeal. It was also agreed that in view of the seriousness of this judgment to the profession of engineering that both the Corporation and the Institute would support Mr. Perry in every way possible.

Mr. Wright stated that in the February number of the *Journal* considerable space would be devoted to this case so that members throughout Canada would be fully informed and would appreciate the seriousness of the situation.

Mr. Wright reported that it had been suggested that the Institute's Committee on Legislation should make a study of the professional engineers' acts of Quebec with the idea of recommending amendments that would do away with the anomalous position brought about by the recent court decision. It was recommended that this committee consult with a similar committee already appointed by the Corporation. It was agreed unanimously that Mr. Poitras, chairman of the committee, should be so instructed.

In the discussion which followed, the opinions of persons from provinces other than Quebec were given and the implications of the decision discussed from the broad point of view. Mr. Carry suggested that rather than line the engineers and architects up on opposite sides it might produce better results if an endeavour were made to have private discussions which might lead to a compromise or some other satisfactory settlement. Mr. Wright explained that an endeavour along these lines had been made in Quebec but that the representatives of the architects refused to discuss future arrangements until the engineers had conceded the point which they were trying to make in their case against Mr. Perry. In other words, once they had everything they wanted they would be willing to discuss the future.

Mr. Chadwick informed Council that he had discussed this case with many firms of architects with which he did business and that, without exception, they had not approved the action of the provincial association of architects.

Mr. Brandon, Mr. Sauder and Mr. Vance also took part in the discussion from the point of view of conditions in their provinces. Eventually the discussion led to the conclusion that the Institute should continue its support of Mr. Perry and that the matter be left with the officers of the Institute as far as further details were concerned. This was moved by Mr. Chadwick, seconded by Mr. Sauder, and approved unanimously.

Committee on Soils Tests—Mr. Chadwick reviewed the events that had begun with the obtaining of certain samples of soil in and around Montreal for Dr. Terzaghi of Harvard University out of which had developed a continuing committee on the subject. He outlined in considerable detail the work which he thought could be done by his committee whereby technical information could be gathered from coast to coast for the guidance of the profession.

He thought that the committee in its final set-up should have a member from each province or perhaps from each district where it is known that there are clays or silts that could be sampled and classified.

The president thanked Mr. Chadwick for his report and suggested that he might put it in such form that it could be printed in *The Engineering Journal.*

Mr. Sauder emphasized the importance of the subject of soil mechanics in Alberta and Saskatchewan, particularly in connection with irrigation. He thought that every endeavour should be made to tie the universities in to the work of Mr. Chadwick's committee, pointing out, at the same time, that short courses had already been carried out on this subject at the Universities of Alberta and Saskatchewan.

Proposal to Increase Annual Fees—Mr. McLeod, as chairman of the Finance Committee, gave some of the history back of the Finance Committee's consideration of the subject of increased fees. He pointed out that the Institute's activities had grown so greatly that it was difficult to maintain the standard of service with the present income. Comparing the Institute, on a membership basis, with similar societies in the United States, he stated that the Headquarters staff was less than one half the size of what it should be. He also pointed out that the increase in membership, particularly among the Students and Juniors, gave the Institute increased opportunities for service which would require expenditure of funds.

The Finance Committee will recommend that the $2.00 voluntary assessment, which is being collected this year, be maintained until the new Finance Committee has an opportunity to study the matter further and to bring proposals before Council. He explained that this information was given simply in the nature of a progress report, but that it was expected that the new Finance Committee would report in greater detail with definite recommendations at a subsequent meeting.

The general secretary announced that the first meeting of the new Council would be held on Thursday, February 8th, in the same room, at two thirty p.m.

The Council rose at six o'clock p.m.

* * *

A meeting of the Council of the Institute was held at the Royal Alexandra Hotel, Winnipeg, on Thursday, February 8th, 1945, convening at three o'clock p.m.

Present: President E. P. Fetherstonhaugh in the chair; Past-President deGaspé Beaubien; Vice-Presidents J. E. Armstrong, G. L. Dickson, C. E. Sisson and R. A. Spencer; Councillors H. L. Briggs, C. W. Carry, R. S. Eadie, J. W. D. Farrell, R. C. Flitton, E. V. Gage, P.E. Gagnon, G. G. Henderson, W. H. M. Laughlin, Alex. Love, E. B. Martin, A. W. F. McQueen, J. M. Patton, P. M. Sauder, W. L. Saunders, C. Stenbol, E. O. Turner and J. A. Vance; Treasurer R. E. Chadwick; Past Vice-Presidents E. V. Caton, L. F. Grant and E. P. Muntz; Past-Councillors H. E. Brandon, A. Jackson, J. G. Hall, H. J. Ward and Stewart Young; S. H. deJong, secretary of the Toronto Branch; C. P. Haltalin, vice-chairman of the Winnipeg Branch; J. B. Stirling, chairman, and W. G. Swan, a member of the Committee on Professional Interests, and General Secretary L. Austin Wright.

On behalf of Council, Past-President Beaubien extended a welcome to the new president, Dean E. P. Fetherstonhaugh, and assured him that he would receive from councillors the same splendid support which made his term of office so pleasant.

Appointment of General Secretary: On the motion of Mr. Gage, seconded by Mr. Sauder, it was unanimously resolved that L. Austin Wright be re-appointed general secretary of the Institute.

Appointment of Treasurer: On the motion of Dean Spencer, seconded by Mr. Vance, it was unanimously resolved that R. E. Chadwick be re-appointed treasurer of the Institute.

Appointment of Committees: On the recommendation of the Striking Committee, and with the approval of the chairman in each case, it was unanimously resolved that the following committees whose list appears in front of this issue be appointed for the year 1945.

Chairmen of Committees—On the recommendation of the Striking Committee, it was unanimously resolved that the chairman of Institute committees for the year 1945 be appointed as shown in front of this issue, and that they be asked to submit the names of the other members of their committees for approval by Council at the March meeting.

Committee on Deterioration of Concrete Structures: Following a somewhat lengthy discussion, it was agreed that the constitution of this committee and the work which it could do to advantage at the present time, should be reviewed and the subject presented again at the next meeting of Council.

Committee on the Young Engineer: In view of the sudden death of Harry F. Bennett, the chairman of this committee, it was agreed that it should be left in the hands of the president to canvass the situation and select a new chairman.

Committee on the Engineer in the Active Services: Colonel Grant advised the meeting that Dean Ellis felt that there were great advantages in having the chairman of such a committee located either in Montreal or Ottawa. Following some discussion, it was decided to leave the appointment of this committee until the next meeting of Council.

Committee on the Engineering Features of Civil Defence—Mr. Armstrong, chairman of this committee since its formation in June 1942, recommended that in view of changed conditions this committee should now be dismissed. This was agreed to, and the thanks of Council were extended to Mr. Armstrong and his committee for the work which they had done.

Vote of Thanks to the University of Manitoba: Several councillors expressed their appreciation of the special convocation carried out by the University of Manitoba for the purpose of conferring an honorary degree of Doctor of Science upon the president of The Engineering Institute of Canada. It was agreed unanimously that this was a most gracious gesture of welcome and recognition, and Council desired to send appropriate thanks to the president of the University for what had been done.

Accordingly, it was moved by Dr. P. E. Gagnon, of Laval University, Quebec, seconded by Dr. E. O. Turner, of the University of New Brunswick, Fredericton, and carried unanimously,

> THAT the Council of The Engineering Institute of Canada is appreciative of the honour which has been conferred by the University of Manitoba upon the president of the Institute, and, through him, upon the profession of engineering. It is grateful to the University, not only for conferring the honour, but for the beautiful and impressive manner in which the ceremony was conducted. This event was one of the most colourful and pleasing that has ever taken place at an annual meeting of the Institute. It will mark this meeting of the Institute in the minds of those who were privileged to be present.
>
> Council takes this opportunity to express its thanks to the Chancellor, the President, and the Dean of Engineering, who combined to make this oustanding event possible.

Vote of Thanks to Retiring Councillors: Vice-President Dickson commented on the efficient way in which the business of the Institute had been handled during the past very successful and busy year. This was due principally to the work of the president and the chairmen of his committees, some of whom are now retiring. He took great pleasure in moving a vote of thanks and appreciation to the retiring president, the retiring vice-presidents and the retiring councillors. In seconding the motion, which was carried unanimously, Dean Spencer remarked that as far as the members in the west are concerned, they appreciated more than ever before the work that has been done by the president and the Council.

Vote of Thanks to the Winnipeg Branch: Vice-President Armstrong stated that it had been his privilege to attend a number of annual meetings of the Institute, but he had been unusually impressed by the way in which this meeting had been handled by the Winnipeg Branch. It gave him great pleasure to move a hearty vote of thanks to the officers, members and ladies of the Winnipeg Branch for their warm welcome, many courtesies and gracious hospitality and for the admirable arrangements made throughout. This was seconded by Mr. Love and carried unanimously.

Tribute to Dr. J. B. Challies: Mr. Stirling asked Council to note particularly that in the selection of chairmen of committees for 1945 his name had been substituted for Dr. Challies as chairman of the Committee on Professional Interests. He pointed out that Dr. Challies' resignation from this committee marked a milestone in the long and remarkable career of that gentleman in Institute work. He noted that Dr. Challies had started first as a member of a committee, then had worked through every office of the Institute with the exception of that of general secretary, culminating in his election as president in 1938. Shortly after his retirement from the presidency he had accepted the chairmanship of the Committee on Professional Interests, and under his skilful guidance branches in several provinces had been aided in developing co-operative agreements with provincial professional associations. The agreements in Saskatchewan, Nova Scotia, Alberta, New Brunswick and Quebec were largely the result of the excellent leadership given by Dr. Challies. Mr. Stirling felt that Dr. Challies' resignation of the chairmanship of the committee should not be allowed to pass without some fitting recognition from Council.

Mr. Vance added his word of praise and appreciation of the work done by Dr. Challies. He regretted that the membership at large would never be able to fully appreciate all that Dr. Challies had done for the Institute, but he agreed with Mr. Stirling that Council should record its appreciation in the minutes of this meeting. therefore he moved:

> THAT the Council of the Institute, observing Dr. Challies' retirement from the chairmanship of the Committee on Professional Interests, desires to place on record an expression of its appreciation of the great work done by him for the Institute and the profession. Council appreciates particularly that Dr. Challies' interest and support has been sustained over a long period of time and has expressed itself in many forms of service. The expanding success of the Institute has been due entirely to the self-sacrificing interest of its members, and therefore Council is indebted to him to an unusual degree. Council hopes that the Institute may continue to enjoy his support in whatever capacity he may choose to serve, and that it may have the benefit of his counsel and advice in the future as it has had in the past.

This was seconded by Mr. Armstrong and carried unanimously.

Resolution to the Mayor and Council of Winnipeg: On the motion of Mr. Eadie, seconded by Mr. Dickson, it was unanimously resolved that the following resolution be transmitted to the Mayor and Council of the City of Winnipeg:

> The Council of The Engineering Institute of Canada at its first meeting of 1945 desired to express to the Mayor and Council of the City of Winnipeg its appreciation of their kindness and hospitality as manifested by the complimentary banquet tendered at the Royal Alexandra Hotel on the evening of February 7th.
>
> The Institute holds it annual meetings in many parts of Canada, but the support given by the City of Winnipeg has not been exceeded elsewhere. The banquet was an outstanding feature of the programme and every one of the five hundred and fifty members and guests is greatly indebted to the city officials. Council agrees readily with the suggestion made by His Honour Mayor Garnet Coulter, and therefore looks forward to the privilege and pleasure of returning to this hospitable community within the not too distant future.

Vote of Thanks to Industrial Organizations: On the motion of Mr. Sauder, seconded by Mr. Vance, it was unanimously resolved that the following resolution should be transmitted to the various industrial organizations who had co-operated with the Winnipeg Branch in promoting the social features of the programme:

Council desires to express its appreciation to the group of industries that has so generously assisted with the social features of the programme of the Fifty-Ninth Annual General Professional Meeting of The Engineering Institute of Canada.

This support and co-operation has assisted materially in making this one of the most outstanding annual meetings in the history of the Institute.

Council expresses the hope that the heavy programme of professional papers in combination with the social events will make a genuine contribution to the advancement of the profession both in Winnipeg and in the rest of Canada, and therefore to the industries themselves.

Vote of Thanks to Speakers and Authors: On the motion of Mr. Farrell, seconded by Mr. Laughlin, it was unanimously resolved that a hearty vote of thanks and appreciation be extended to the various speakers and authors who had contributed so much towards the outstanding success of the technical sessions and other functions.

Thanks to the Hotel Staff and Management: On the motion of Mr. Stenbol, seconded by Mr. Flitton, 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 accommodation of the guests. Never had the Institute received better service or better food, which had contributed in no small measure towards the outstanding success of the meeting.

It was decided that the next meeting of Council would be held in Montreal on Saturday, March 17th, on which date it was expected the president could be present.

The Council rose at five o'clock p.m.

ELECTIONS AND TRANSFERS

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

Members

Ball, J. Stewart, B.A.Sc. (Univ. of Toronto), mech. & mtce. engr., Shell Oil Refinery, Montreal East, Que.

Bohraus, Werner, Elec. Engr. (Swiss Federal Inst. of Tech., Zurich), designing elec. engr., Ontario Paper Co. Ltd., Thorold, Ont.

Eon, Louis Guy, Lieut. Colonel (Quebec Tech. School), Cdn. Army Operational Research Group, Cartier St. School, Ottawa, Ont.

Gussow, William Carruthers, B.Sc. & M.Sc. (Queen's Univ.), Ph.D. (M.I.T.), res. engr., Aluminum Co. of Canada Ltd., Arvida, Que.

Murray, Ralph Mills, Major, R.C.E. (Univ. of N.B.), engr., design section, Directorate of Wks. & Constrn., N.D.H.Q., Ottawa, Ont.

Raidel, Isaac Samuel, B.Sc. (Civil), (Univ. of Man.), personnel training engr. & engrg. consultant, MacDonald Bros. Aircraft Ltd., Winnipeg, Man.

Robillard, Louis Alfred, B.Sc. (Univ. of Mich.), genl. master mech., Shawinigan Chemicals Ltd., Shawinigan Falls, Que.

Rodwin, Stefan, Mech. Engr. (Univ. of Dantzig), chief engr., aircraft divn., Canadian Car & Foundry Co., Montreal.

Stacey, Leonard Brown, B.A.Sc. (Elec.), (Univ. of B.C.), dist. mgr., Packard Elec. Co. Ltd., Vancouver, B.C.

Trueman, James Cobden, B.Sc. & M.Sc. (McGill Univ.), chief designing engr., Dominion Bridge Co., Winnipeg, Man.

Juniors

Anderson, Thomas Tulloch, B.A.Sc. (Chem. Eng.), (Univ. of B.C.), asst. supervisor, hydrate dept., Bayer ore plant, Aluminum Co. of Canada, Arvida, Que.

Barber-Starkey, Joseph William Mainguy, Lieut. (E) R.C.N., (Royal Naval Engrg. Coll., Devonport), R.R. 1, Sidney, B.C.

Stann, Daniel Alexander, Elect. Lieut., R.C.N.V.R., B.Sc. (Elec.), (Univ. of Man.), on Cdn. cruiser overseas.

Affiliate

Kelly, Ernest A., mgr., Sault Structural Steel Co. Ltd., Sault Ste. Marie, Ont.

Transferred from the class of Junior to that of Member

Langston, John Francis, B.Sc. (Civil), (Univ. of Alta.), petroleum engr., General Petroleums Ltd., Calgary, Alta.

Pope, Francis Robert, B.Eng. (Mech.), (McGill Univ.), asst. supt., Western Clock Co. Ltd., Peterborough, Ont.

Transferred from the class of Student to that of Member

Dupuy, Harry Edward Glen, B.Eng. (Mech.), (McGill Univ.), mgr., Babcock-Wilcox & Goldie-McCulloch, Ltd., Winnipeg, Man.

Mason, George Anthony Ritchie, B.Sc. (Elec.), (Univ. of Alta.), Central Alberta Sanatorium, Calgary, Alta.

Pepall, James Edward, B.A.Sc. (Chem.), (Univ. of Toronto), asst. alumina plant supt., Aluminum Co. of Canada, Arvida, Que.

Transferred from the class of Student to that of Junior

Baxter, John Frederick, B.Eng. (McGill Univ.), junior engineer, Barranca refinery, International Petroleum Co. Ltd., Barranca-Bermeja, Colombia, S.A.

Bishop, Percival William, B.Sc. (Civil), (Univ. of N.B.), transitman, C.P.R., Oliver, B.C.

Brett, John Edward, B.Eng. (McGill Univ.), consulting engr., 4180 Melrose Ave., Montreal.

Findlay, Allan Cameron, F/O, R.C.A.F., B.Eng. (McGill Univ.), Engrg. Officer, Aircraft Mtce., R.C.A.F., Sidney, B.C.

Smith, Robert Lovelace, B.Sc. (Elec.), (Univ. of Man.), mfg. engr., Northern Electric Co. Ltd., Montreal.

Stopps, Frank Sidney, B.Eng. (Mech.), (McGill Univ.), engr., Longueuil plant, Dominion Engineering Works, Ltd., Montreal, Que.

Strachan, Jack Lyon, B.Sc. (Elec.), (Univ. of Man.), engr., Defence Industries, Ltd., Montreal, Que.

Valiquette, Pierre Francis, B.A.Sc., C.E. (Ecole Polythechnique), business agent, Shawinigan Water & Power Co. Ltd., Montreal, Que.

Admitted as Students

Church, James Walter (Queen's Univ.), 556 Johnson St., Kingston, Ont.

Fead, John William Norman, 10835–86th Ave., Edmonton, Alta.

Garland, Hedley Robert, (Nova Scotia Tech. Coll.), 319 Spring Garden Road, Halifax, N.S.

Goodwin, Martin Jerome, (McGill Univ.), 3515 Durocher St., Montreal.

Holyoke, Donald Ralph, (Univ. of N.B.), 323 St. John St., Fredericton, N.B.

Jones, Owen James, (Univ. of Alta.), Coleman, Alta.

Lantz, Gerald Gordon, B.Sc. (Elec.), (N.S. Tech. Coll.), Fairview, N.S.

Meurling, Alric Fritiof, (Univ. of N.B.), Marysville, N.B.

Nelson, Leslie William, (Univ. of Alta.), 11153—Sask. Drive, Edmonton, Alta.

Roshko, Anatol, (Univ. of Alta.), 11135—84th Ave., Edmonton, Alta.

Winterbourne, John Anderson, B.Sc. (Elec.), 60 Cambridge St., Halifax, N.S.

Students at the University of Manitoba

Kato, Yoichi, 149 Claremont Ave., Winnipeg, Man.

Klassen, Harold, 165 Cathedral Ave., Winnipeg, Man.

McLean, Donald Hugh, 221 Marion St., Norwood, Man.

Nunn, Edwin Charles, 109 Lansdowne Ave., Winnipeg, Man.

Oldfield, Allan Norman, 819 Ingersoll St., Winnipeg, Man.

Ostevik, Sigurd Torleif, 429 Furby St., Winnipeg, Man.

Phillips, Herbert Frederick, 88 Imperial Ave., St. Vital, Man.

Shabaga, William, 859 Bannatyne Ave., Winnipeg, Man.

Zaharuk, Peter, 73 Furby St., Winnipeg, Man.

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

Dr. C. B. Thorne, M.E.I.C., vice-president and technical director of Canadian International Paper Company, has retired from active direction of the bleached sulphite operations of the company's mills at Hawkesbury, Ont., and Temiskaming, Que., after continuous service of more than 40 years with the company and its predecessors. He had joined the old Riordon Paper Company in 1903 soon after his arrival in America from Norway.

Dr. Thorne enjoys an international reputation and is distinguished in the fields of research and invention as well as mill operation. In 1934 he was invested by King Haakon of Norway with the rank of Knight Commander of the St. Olav Order. In 1938 the Technical Association of the Pulp and Paper Industry of the United States awarded him its gold medal, its highest mark of merit, in recognition of the part he played in the formation of the Association and his contributions to the science of pulp manufacture.

Dr. Thorne will still reside in Hawkesbury where he expects to devote himself to research in his chosen field of cellulose chemistry and its industrial applications. He will remain a vice-president of the company.

E. R. Jacobsen, M.E.I.C., assistant director general of the Commonwealth of Australia War Supplies Procurement, has recently been elected to membership in the American Branch of the Newcomen Society of England.

L. E. Mitchell, M.E.I.C., is the newly elected chairman of the Halifax Branch of the Institute. He graduated from Mount Allison University in 1930 with a B.A. degree and from the Nova Scotia Technical College in 1932 with a B.Sc. in mechanical engineering. He joined the staff of the Halifax refinery of the Imperial Oil Limited on graduation and has been in the employ of this company and its South American subsidiaries ever since. Mr. Mitchell served for a period of six years with the International Petroleum Co. Ltd. in Peru and the Tropical Oil Company in Colombia and is at present chief engineer of the Halifax refinery.

H. L. Clifford, M.E.I.C., who has been with the Quebec Shipyards Ltd. at Quebec as general manager for the past year, has returned to his position of general superintendent with Dufresne Engineering Company Limited, Montreal.

Alan K. Hay, M.E.I.C., has recently resigned his position as engineer to the Ottawa Suburban Roads Commission to accept an appointment as superintendent of the Federal District Commission.

D. D. Whitson, M.E.I.C., has recently returned to his former position in the City of Toronto, Department of Buildings, after serving as chief structural engineer for the Works and Buildings Branch, Naval Service, Department of National Defence, Ottawa.

W. E. Seely, M.E.I.C., is at present employed by Noorduyn Aviation Ltd., Montreal, as engineering change co-ordinator. He was formerly serving as a flying officer in the Royal Canadian Air Force.

W. A. Newman, M.B.E., M.E.I.C.

W. A. Newman, M.B.E., M.E.I.C., formerly chief mechanical engineer of the Canadian Pacific Railway, has been named head of the new department of research set up by the railway recently. The new department will delve into all matters of railway operation and will concern itself with the elimination of waste of both effort and material and the development and improvement of facilities and service in the post-war period.

J. L. Bieler, M.E.I.C., has been appointed Director of the Industrial and Engineering Development Division of Robert A. Rankin and Company, consulting industrial and chemical engineers, Montreal. This new Division will direct the company's efforts in the establishment and rehabilitation of industry, with respect to placement, construction, and effective development.

Mr. Bieler graduated from McGill University in mechanical engineering in 1923 and became associated with the Bailey Meter Co. of Cleveland, Ohio, working in both Cleveland and Montreal until 1925. In the following year he joined the staff of Industrial Combustion Engineers in London, England, eventually becoming chief engineer of the company. In 1928 he returned to Canada, joined the engineering staff of Dominion Oilcloth and Linoleum Co., Montreal, and later became chief engineer. In August 1940 he was named chief of the Fuse Division in the Ammunition Production Branch, Department of Munitions and Supply, Ottawa. From June 1943 until his present appointment he was in the engineering department at Williams and Wilson Ltd., Montreal, dealing with new developments, and pulp, paper and hydraulic equipment.

Euclide Paré, M.E.I.C., has recently been appointed chief engineer of the hydraulic branch of the Department of Lands and Forests of the Province of Quebec at Quebec. A graduate of the Ecole Polytechnique in the class of 1931, he joined the Department in 1936.

A. G. MacKay, M.E.I.C., is at present employed by the Nova Scotia Construction Company at Halifax. He was formerly superintendent of Anglin-Norcross Limited at Halifax.

C. K. S. Macdonell, M.E.I.C., of the Ontario Department of Highways, has been transferred from Huntsville to Sudbury.

J. P. Fraser, M.E.I.C., has been appointed assistant chief engineer of the British Columbia Electric Railway Company of Vancouver. He was with the Manitoba Power Commission until 1940 when he left to take the position of superintendent of generating plants with the British Columbia Electric Railway Company. In 1943 he was made superintendent of the operating division in charge of generating stations and substations, which position he held until his recent promotion.

W. R. Way, M.E.I.C., formerly assistant general superintendent of the operating department of the Shawinigan Water & Power Company, has been promoted to the position of general superintendent, filling the vacancy caused by the retirement of C. R. Reid, M.E.I.C.

Harry G. Stead, M.E.I.C., is the newly elected chairman of the London Branch of the Institute. Born at Wilton Grove, Ont., he received his education at London Central Collegiate and London Technical School. In 1923 he entered the employ of E. Leonard & Sons Limited in London, Ont., as an apprentice draftsman and four years later was made mechanical draftsman. He worked as chief draftsman with the firm from 1931 until 1938 when he was promoted to chief engineer, in charge of design estimates and all engineering work. He is now president and chief engineer of the recently re-organized company.

Mr. Stead joined the Institute as a Junior in 1938, transferring to Member in 1943.

J. P. Fraser, M.E.I.C.

W. R. Way, M.E.I.C.

Harry G. Stead, M.E.I.C.

Lt.-Col. H. L. Sherwood, M.E.I.C., formerly district engineer officer for Military District No. 11, Victoria, B.C., has been re-elected chairman of the Victoria Branch of the Institute. Graduating from the Royal Military College in 1903, he was employed with the construction department of the Canadian Pacific Railway until 1914 when he went overseas with the Canadian Railway Construction Corps. In 1917 he was promoted to major. From 1919 until 1923 he was on the staff of the Department of National Defence Headquarters, Ottawa, as a permanent force officer of the Royal Canadian Engineers. During the next six years he served as district engineer officer, M.D. 3, Kingston, Ont., and from 1929 until 1936 occupied the same position in M.D. 10 at Winnipeg, Man. He was then transferred to M.D. 11, Victoria, where he served in the same capacity until his retirement in 1941. He was promoted to lieutenant-colonel in 1939.

Col. Sherwood joined the Institute as a Student in 1903, transferring to Associate Member in 1907. In 1941 he became a Life Member of the Institute.

F. C. Morrison, M.E.I.C., is at present in Montreal with the Dominion Steel and Coal Corporation Ltd. He was previously with the Dominion Coal Company Ltd., a subsidiary, at Halifax, N.S.

Jacques Limoges, M.E.I.C., formerly district engineer with the Department of Highways at Quebec, is at present with La Société d'Entreprises Générales, Ltée, at Amos, Que.

John Leabourne Shearer, M.E.I.C., has been appointed engineer to the Ottawa Suburban Roads Commission. He is a graduate of Queen's University and has had extensive experience in various branches of civil engineering including highways, bridge construction, drainage, sewerage, and water supply. From 1928 until 1933 he held various positions in western Canada and on the Pacific coast in connection with municipal engineering construction work of various types.

In 1934 he returned to Ottawa and was for two years in charge of construction of large relief sewers being built by the City of Ottawa under the engineering department. Following this he was employed by N. B. MacRostie, civil engineer, Ottawa, in drawing up reports on certain flood conditions in southern Ontario After a short interval with Donald-Hunt Ltd., Montreal, and with the Aluminum Company of Canada Limited, Arvida, Que., he was for two years on the staff of the Ottawa Division of the Ontario Department of Highways. More recently he has been employed in the assessment department of the City of Ottawa.

Norman Marr, M.E.I.C., is the chairman of the Ottawa Branch of the Institute for the present year. 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. After graduation he was employed as assistant engineer with Messrs. C. H. and P. H. Mitchell, consulting engineers on construction of La Colle Falls hydro-electric development for the City of Prince Albert, Sask. From 1913 until 1918 he was assistant engineer with the Department of Railways and Canals in charge of construction of sections of the Trent Canal. 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.

L. P. Cousineau, M.E.I.C., has recently returned to the Dufresne Engineering Company Ltd., Montreal, and is at present assistant superintendent on the construction of the highway bridge at Ste. Rose, Que. He had been on loan to Quebec Shipyards Limited at Quebec for the past year.

J. D. Fraser, M.E.I.C., who has been with the Acadia Sugar Refining Company Limited at Dartmouth, N.S., is now employed by Moirs Limited at Halifax, N.S.

Norman A. Eager, M.E.I.C., is the chairman of the Hamilton Branch of the Institute for the present year. Born at Montreal, Que., he received his education at McGill University where he obtained the degree of B.Sc. in 1922 and at Cornell University where he received his M.C.E. the following year. Upon graduation he went with the Illinois State Highways as resident engineer and a year later was with the Canadian Vickers Limited in Montreal. He then became superintendent of construction with Church & Ross Company, contractors of Montreal. In 1926 he joined the Shawinigan Water & Power Company where he was engaged in structural engineering and later in power sales research work. In 1940 he went with the Burlington Steel Company, Hamilton, Ont., as assistant sales manager. Last year he was promoted to sales manager which position he now holds.

Mr. Eager joined the Institute as a Junior in 1925, transferring to Associate Member in 1934 and becoming a Member in 1940.

Elzear N. Gougeon, M.E.I.C., who was formerly employed by Quebec Shipyards Ltd. at Quebec is now with the Dominion Containers Ltd., Montreal, as production engineer.

Major H. L. Hurdle, O.B.E., Jr.E.I.C., has recently returned from overseas to attend a six months' staff course at the Royal Military College at Kingston, Ont.

George Ross, Jr.E.I.C., has taken a position in the sales and contract department of the Hamilton Bridge Company at Hamilton, Ont. He was formerly a squadron leader in the R.C.A.F. and has received the King's commendation for valuable services in the air.

F/O Marcel Papineau, Jr.E.I.C., has recently returned to Canada after completing his first tour of operations in England as a navigator.

Raymond A. Frigon, Jr.E.I.C., lecturer in mechanics of materials at Ecole Polytechnique, Montreal, has been made assistant engineer, Diesel Engine Division, Dominion Engineering Works Ltd. at Lachine, Que. Mr. Frigon is chairman of the Junior Section, Montreal Branch of the Institute, for the present year.

G. K. Narsted, Jr.E.I.C., who has been with the Aluminum Company of Canada Limited at La Tuque, Que., has been transferred to Aluminum Goods Limited at Toronto, Ont.

S. D. Foote, Jr.E.I.C., of the British American Oil Company Limited, has been transferred from Toronto to the Calgary refinery as resident engineer.

F. S. Bestwick, S.E.I.C., is at present employed by the English Electric Company of Canada, Limited, at St. Catharines, Ont.

Wm. K. Campion, S.E.I.C., has enlisted in the R.C.-E.M.E. and is in training at Barriefield, Ont. He graduated from Queen's University with a B.Sc. in 1944.

T. A. Miller, S.E.I.C., is now employed as an engineer with the Trans-Canada Airlines at Winnipeg, Man.

Obituaries

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

Harry Frederick Bennett, M.E.I.C.

1888—1945

"That life is long which answers life's great end"

The engineer's training and daily work is usually of a character which encourages and develops in those who successfully follow the calling, a number of admirable qualities. Among these are sincerity, avoidance of pretence, a striving for excellence, consideration for the needs of others, and a desire to render service to fellow members of the profession and to the public.

By the unexpected death of Harry Frederick Bennett in London, Ontario, on the last day of January, 1945, the Institute has lost a prominent member whose life and career exemplified the truth of these observations. As a citizen, as a public servant, and in all his professional work, he gained wide esteem. He was greatly concerned with problems affecting the entry of the young engineer into the profession, the rehabilitation of returned men, and their future in engineering work. He had been active in furthering the Institute's discussions of these matters, and his efforts, with those of the committees over which he presided, had already yielded valuable results. It will not be easy to find an equally effective leader to take his place.

One of the Institute's most ambitious undertakings was the provision, through a wide-spread committee, of advice and counsel to high school students and their parents to the end that the youth of Canada might be assisted in choosing that vocation which most nearly suited its talents. From the beginning in February 1939, the committee has been under the chairmanship of Harry Bennett.

One of the principal accomplishments of the committee has been the preparation of a booklet "The Profession of Engineering in Canada", used as the basis for all preliminary counselling. This has been so well received that it has gone into a second edition and has been translated into French. It is now used by the Canadian Legion Educational Services and has been supplied in large numbers to the R.C.A.F., to be used in advising young men in advance of demobilization. It has gone to the principal of every high school in Canada, and over 25,000 copies have been distributed. This booklet is an achievement of Harry Bennett. It is a sign of his interest in young men and of his desire for a high status for the profession. It is an example of his industry, his foresight and his intelligence.

Harry Frederick Bennett was born at Saint John, N.B., in 1888. He graduated from the University of New Brunswick, in civil engineering, in 1908; in the same year he joined the staff of the Public Works Department of Canada at Saint John.

During the earlier years of World War I he served in the 9th Siege Battery, Canadian Artillery, in Saint John, later reverting from the rank of captain to that of lieutenant in order to go overseas with the 48th Howitzer Battery, Canadian Artillery.

After the war he returned to his position in Saint John. In 1924 he was appointed senior assistant engineer, being transferred to the Halifax district, where he remained until his promotion in 1930 to become district engineer at Sault Ste. Marie, Ont. In 1936 he was promoted to the position of district engineer of the more important district of London, Ontario, which he occupied until his death. This district extends from Port Colborne along the north shore of Lake Erie, along the Detroit river, Lake St. Clair, Lake Huron to Tobermory and down to Wiarton. He was in charge of the harbour development throughout this wide area, for which he had prepared extensive post-war plans.

Having joined The Engineering Institute of Canada as a Student in 1907, he became a Junior in 1914, an Associate Member in 1920, and a Member in 1935. He served as chairman of the respective Institute branches while at Saint John, Sault Ste. Marie and London, was a member of Council for several terms, and at the time of his death had just completed his sixth annual report as chairman of the Institute Committee on the Training and Welfare of the Young Engineer. He had recently been appointed chairman of a joint committee, known as The Canadian Committee for Student Guidance in Science and Engineering, on which there sit representatives of The Engineering Institute of Canada, the Canadian Institute of Mining and Metallurgy, and the Chemical Institute of Canada.

In addition to the many duties in connection with his professional work, he found time to write on technical subjects, and to enter effectively into the community life of the city where he lived. He was a director of the London Canadian Club, a past-president of the Current Topic Club, an active officer of the Metropolitan United Church, and regional coordinator for the London District during each of the last five Victory Loan campaigns.

Of sterling worth as a citizen and an engineer, the record of his life speaks for itself. R.J.D.

James Williams Tyrrell, M.E.I.C., died at his home in Bartonville, Ont., on January 16th, 1945. Born at Weston, Ont., on May 10th, 1863, he received his preliminary education in the Weston schools and later attended the School of Practical Science, University of Toronto, graduating with a C.E. degree in 1889. He was subsequently made a Dominion Land Surveyor. Mr. Tyrrell engaged in private practice as a civil engineer and land surveyor in Hamilton, Ont., and in 1892 was appointed county engineer for Wentworth. He was in charge of several construction projects and engaged in the location of railways.

As a surveyor for the federal government Mr. Tyrrell had been in almost every part of Canada and had explored or surveyed as far as the Arctic Ocean. In 1893, under the auspices of the Canadian Geographical Survey, a department of the government, he and his brother explored the unknown barren lands of the northwest, situated west of Hudson Bay and north of the Saskatchewan river. In the following year he published a book "Across the Sub-Arctics of Canada" describing his experiences on the 3,200-mile trip by canoe and snowshoe. He had a wide knowledge of the people inhabiting the most northerly regions in Canada and of their customs and had occasionally lived several weeks among the Eskimos, whose language he spoke. His reports furnished valuable statistics to the government and his work in mapping out these northern tracts of land has proved of great worth.

Mr. Tyrrell lived for two years on Big Island in Hudson Strait and also surveyed the harbours of Labrador, the region around Great Slave lake and the mining area of northern Ontario. He was one of the first to stake out a claim in the Red Lake district which later proved to be one of the richest mining areas in the Dominion. He was president of the Tyrrell Red Lake Mines and until recently had been in charge of a mine in the Kirkland Lake area of which his brother was president. He was one of the pioneers in developing the Lake of Bays district in Muskoka as a mecca for summer residents.

Mr. Tyrrell had joined the Institute in 1896 as a Member becoming a Life Member in 1932.

Major Duncan Seward Morrison, M.E.I.C., died at his home in Sydney, N.S., on December 12th, 1944. Born at Catalone, Cape Breton, on February 3rd, 1878, he received his education at Sydney Academy. Prior to graduating he enlisted and went to South Africa during the Boer War. He was invalided home towards the end of the campaign and on recovery joined the survey staff of the Dominion Coal Company. He remained with that company for 43 years. He took advantage of the early Government Mining Schools set up in the Nova Scotia coal fields, receiving one of the first mine manager's certificates issued by the province under their revised Mining Act.

With the Dominion Coal Company, Major Morrison became chief mine surveyor, field engineer, and assistant to both resident and mining engineers. During the first World War he was commissioned a captain and instructed to raise a field company of engineers. Qualifying for his majority in 1935 he organized the 9th Field Company at Glace Bay, which unit was among the first to be called in September, 1939. On loan from the company he was town engineer for the Town of Waterford while the sewer system and pavement were being installed and continued to act as consulting engineer for them up to the time of his death.

Major Morrison became a Member of the Institute in 1940.

NEWLY ELECTED OFFICERS OF THE INSTITUTE

J. E. Armstrong, M.E.I.C., chief engineer of the Canadian Pacific Railway, Montreal, has been elected vice-president of the Institute for the province of Quebec. Born in Peoria, Ill., he graduated from Cornell University in 1908 and from that date until 1912 was assistant on the engineer corps of the Cleveland and Pittsburgh Division of the Pennsylvania Company at Cleveland, Ohio. In 1912 he joined the staff of the Canadian Pacific Railway at Montreal as an engineer and in 1928 became assistant chief engineer of the company. In 1938 he was appointed chief engineer. He has been engaged on many important works including the Quebec joint terminals, the waterfront development at Saint John, railway revision during the war, and the construction of the Toronto viaduct from 1924 until 1930.

J. E. Armstrong, M.E.I.C.

C. E. Sisson, M.E.I.C.

R. A. Spencer, M.E.I.C.

In 1927 Mr. Armstrong was a director in the American Railway Engineering Association and in the following year became second vice-president. In 1934 he was appointed president and with election to this office he automatically became chairman of the engineering division of the American Railway Association. In 1940 he was president of the Canadian Railway Club.

Mr. Armstrong joined the Institute as an Associate Member in 1917 becoming a Member in 1940. In 1942 he was elected a councillor of the Institute. He has served on the Finance Committee for the past six years, and is now the chairman.

C. E. Sisson, M.E.I.C., managing engineer at the Davenport Works of the Canadian General Electric Company in Toronto, is the newly elected vice-president of the Institute for the province of Ontario. Born at Cavan, Ont., he received his secondary education at Peterborough and taught school for a time, after which he joined the testing staff of the Canadian General Electric Company at Peterborough in 1901. He then took the electrical engineering course at the University of Toronto and graduated in 1905. After graduation he returned to the engineering staff of the C.G.E. at Peterborough with which company he has been continuously associated. In 1921 he moved to the Davenport Works, Toronto, where he assumed responsibility as works engineer. He was later promoted to the position which he now holds.

Mr. Sisson has been chiefly interested in transformers and has witnessed the development of this line of apparatus from its early stages of small units to the production of the largest and most complicated ratings built anywhere. He has been interested in the planning and development of the company's educational programme for the young engineer.

Mr. Sisson joined the Institute as a Member in 1919. He was chairman of the Toronto Branch in 1940 and councillor of the Institute in 1941-42.

R. A. Spencer, M.E.I.C., Dean of Engineering, University of Saskatchewan, has been elected vice-president of the Institute representing the western provinces. Born at Port Morien, N.S., he graduated from McGill University with the degrees of B.Sc. in 1914 and M.Sc. in 1915. After some early engineering experience with Dominion Coal Company and Canadian Pacific Railway he spent more than three years overseas with the 1st Canadian Tunnelling Company and 7th Battalion Canadian Engineers. He held the rank of major and was awarded the Military Cross and Bar. At the end of the war he studied at University College, London, and London School of Economics and on his return was appointed professor of engineering at Dalhousie University, Halifax. In 1920 he worked as resident engineer with the St. Margaret's Bay Water Power Development and in the following year was appointed assistant professor of civil engineering at the University of Saskatchewan. In 1924-25 he was granted leave of absence to work with the Foundation Company of Canada.

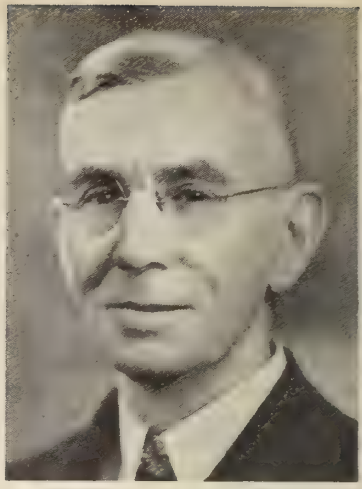
From 1925 to the present time he has been professor of civil engineering at the University of Saskatchewan, Saskatoon, and has also carried on an extensive consulting practice. Last October he was appointed Dean of the College of Engineering.

Dean Spencer joined the Institute as a Student in 1907, transferring to Junior in 1913, to Associate Member in 1919, and becoming a Member in 1940. He was councillor of the Institute in 1937-38 and at that time served as chairman of the Committee on Membership and Management. From 1939 to 1944 he was chairman of the Board of Examiners and Education.

John N. Finlayson, M.E.I.C., is the newly elected councillor of the Institute representing the Vancouver Branch. Born in Merigomish, N.S., he graduated from McGill University with the degree of B.Sc. in 1908

J. N. Finlayson, M.E.I.C.

C. W. Carry, M.E.I.C.



J. McD. Patton, M.E.I.C.

and M.Sc. in 1909. He received the degree of LL.D. from the University of Manitoba in 1940. From 1908 until 1911 he was a lecturer in mathematics at McGill University and in 1910-1913 was with the firm of Waddell and Harrington, consulting engineers of Kansas City and Vancouver, as detailer, inspector and resident engineer on the erection of bridges, including 19 steel bridges for the Canadian Northern Railway between Vancouver and Kamloops. From 1913 until 1919 he was professor of civil engineering at Dalhousie University, Halifax, and at the same time carried on a private practice as consulting engineer, specializing in the design of steel and reinforced concrete structures and in arbitrations. He was professor of civil engineering at the University of Manitoba from 1919 until 1936 when he was appointed dean of the faculty of applied science and head of the department of civil engineering at the University of British Columbia, Vancouver.

Dean Finlayson joined the Institute as a Student in 1908, transferring to Associate Member in 1912 and to Member in 1919. He has served as chairman of the Winnipeg Branch.

Charles W. Carry, M.E.I.C., has been elected councillor of the Institute representing the Edmonton Branch. Born in Winnipeg, Man., he graduated from the University of Manitoba with the degree B.Sc. (C.E.) in 1926 and M.Sc. (C.E.) in 1929. During his university years he had engineering experience with the Canadian Pacific Railway Construction and Maintenance of Way Departments. In 1926-27 he was lecturer in the department of civil engineering at the University of Manitoba. Mr. Carry joined the Dominion Bridge Company Limited at Winnipeg in 1927 and except for one short interval has remained in that organization since that time. From 1927 until 1932 he was at the Winnipeg plant as draftsman, designer, assistant to contract engineer, and plant engineer respectively. He was then moved to Manitoba Bridge and Iron Works Limited where he remained until 1935 on plant appraisal, estimating and sales. In 1936 he moved to Riverside Iron Works, Calgary, on engineering and sales. Two years later he transferred to the Standard Iron Works Limited at Edmonton where he is at present located as engineer on design and sales.

Mr. Carry joined the Institute as an Associate Member in 1939 becoming a Member the following year.

J. McD. Patton, M.E.I.C., is the newly elected councillor of the Institute representing the Saskatchewan Branch. During 1912-13 he was employed as superintendent of waterworks for the City of Regina. For the next three years he served as chief engineer for the Saskatchewan Water Commission reporting on the feasibility of diverting water from the Saskatchewan River to serve Regina, Moose Jaw and district. In 1916 he became assistant bridge engineer of the Department of Highways and Transportation and has remained with the department until the present time. Rapid expansion of the highway system has involved the design and construction of many new bridges and railway separation projects.

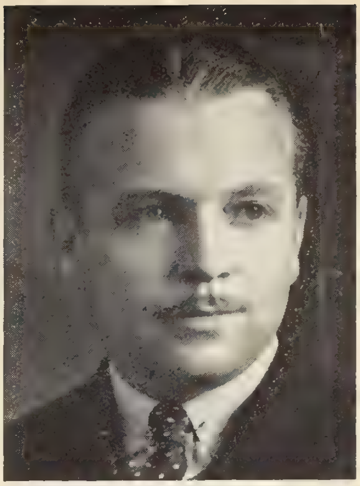
Mr. Patton's interest in the Institute started in 1917 when he became an Associate Member at the time of the establishment of the Saskatchewan Branch of the Canadian Society of Civil Engineers and has been sustained since that time. He transferred to a Member of the Institute in 1936. In 1937 he was vice-chairman of the Saskatchewan Branch at the time of the negotiations for a co-operative agreement with the Association of Professional Engineers of Saskatchewan. In 1940-42 he served as councillor on the combined executive of Saskatchewan Branch and the Association. In 1943-44 he was vice-chairman of the Saskatchewan Branch of the Institute and vice-president of the Association of Professional Engineers of Saskatchewan. For the current year he is serving as chairman and president respectively of the two organizations.

J. W. D. Farrell, M.E.I.C., superintendent of water works for the City of Regina, Sask., has been reappointed to the Council of the Institute representing the Association of Professional Engineers of Saskatchewan. Born at Smith's Falls, Ont., he received his education at the Moose Jaw Collegiate Institute and at Queen's University from which he graduated with his B.A. in 1912 and his B.Sc. in 1915. During the first world war he served with the Royal Canadian Engineers and with the Royal Flying Corps and the Royal Air Force. On his return to civilian life he entered the Department of Irrigation in Calgary as draftsman and in 1920 was made assistant superintendent of water works for the City of Regina. Four years later he was promoted to superintendent which position he holds at the present time. During the present war he served for a time as a major in the R.C.E.T.C. when he was stationed at Chilliwack, B.C., but he has now returned to his civilian occupation.

Major Farrell joined the Institute as a Junior in 1920, transferring to an Associate Member the following year and to a Member in 1935.

R. B. Chandler, M.E.I.C.

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



W. H. M. Laughlin, M.E.I.C.

R. B. Chandler, M.E.I.C., general manager of the Public Utilities Commission of Port Arthur, has been elected councillor for the Institute representing the Lakehead Branch. Born at Stratford, Ont., he graduated from the University of Toronto as a B.A.Sc. in 1912. Upon graduation he went to Saskatoon as assistant city engineer. From 1914 until 1916 he was resident engineer with the Board of Grain Commissioners for Canada at Saskatoon and Calgary. He joined the staff of C. D. Howe & Company at Port Arthur in 1916 and was employed as a designing and supervising engineer until 1923 when he became a partner in the firm. He left the firm in 1933 and for two years was in private practice as a consulting engineer. In 1935 he was appointed general manager of the Public Utilities Commission of Port Arthur. Mr. Chandler has acted as consulting engineer on construction of important industrial plants including terminal grain elevators, warehouses and docks. In 1930 he made an investigation of grain handling facilities in Argentina.

Mr. Chandler joined the Institute as an Associate Member in 1917 transferring to Member in 1923. He has served as chairman of the Lakehead Branch.

G. G. Henderson, M.E.I.C., is the newly elected councillor of the Institute representing the Border Cities Branch. Born in Midland, Ont., he graduated from the University of Toronto in 1924 with the degree of B.A.Sc. in civil engineering. After graduation he entered the employ of the Canadian Bridge Company at Walkerville, Ont., and has been connected with the firm since that time. In 1939 he was made contracting engineer and in 1941 was appointed assistant general manager of the company.

Mr. Henderson joined the Institute as a Member in 1939. In 1942 he was elected vice-chairman and the following year chairman of the Border Cities Branch.

J. A. Vance, M.E.I.C., engineer and contractor of Woodstock, Ont., has been re-elected councillor of the Institute representing the London Branch. Born in the County of Oxford, Ont., he was educated at the University of Toronto. On the death of his father in 1914 he took over the contracting business and became responsible for the administration, engineering and construction of steel and concrete highway bridges. He is now the proprietor and engineer of the firm of J. A. Vance, contractor, at Woodstock. The business has grown to include the design and construction of factory buildings, sewers, dams and various concrete and steel structures.

Mr. Vance joined the Institute as a Student in 1914 transferring to Junior in 1919. He became an Associate Member in 1924 and a Member in 1939. He has been re-elected councillor for the London Branch each consecutive year since 1933.

W. H. M. Laughlin, M.E.I.C., has been elected councillor of the Institute representing the Toronto Branch. Born in Toronto, Ont., he is a graduate in engineering from the University of Toronto in the class of 1927. He has been with the Dominion Bridge Company, Limited at Toronto since his graduation, joining first as a structural designer and estimator and now occupying the position of designing engineer. He is also demonstrator in civil engineering at the University of Toronto.

Mr. Laughlin joined the Institute as an Associate Member in 1929 becoming a Member in 1940. He has always been active in the Toronto Branch. He has served as chairman of the Branch and has been a member of the executive committee for several years.

Richard A. Low, M.E.I.C., is the newly elected councillor of the Institute representing the Kingston Branch. Born in Ottawa, Ont., he received his early education in the Ottawa Public Schools and the Lisgar Collegiate Institute. His engineering education was interrupted by the first Great War and he served in the gauge laboratory, Imperial Munitions Board, from 1916 until 1918. Following the war he was engaged on government and railway surveys in various capacities and in 1922 joined the Topographical Surveys, Department of the Interior. He later transferred to the Chief Geographer's Branch but resigned in 1925 to further his education. He graduated from Queen's University in 1928 with a B.Sc. in civil engineering and joined the teaching staff of that institution in 1930, where he is now assistant professor of civil engineering. He holds the degree of Master of Civil Engineering from Cornell University.

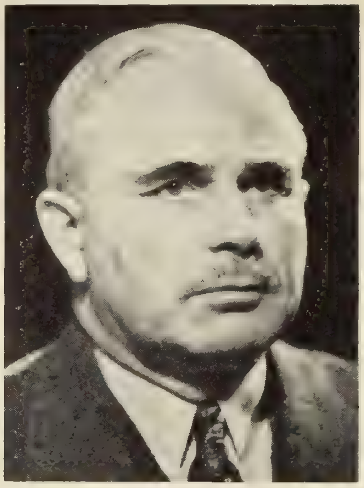
Although Professor Low has been engaged in teaching for 14 years he has not neglected the practice of his profession and most summers are spent on engineering projects. He has worked in many capacities on geodetic, railway and highway surveys and construction jobs. He made the final location of the Quebec Chibougamou Railway and also located the south section of the Isle Maligne-Quebec transmission line for the Shawinigan Water and Power Company. Shortly after the outbreak of the present war he joined the gauge division, Department of Munitions and Supplies in Ottawa, and served during its period of organization, returning to Queen's in the autumn of 1942. He has long been interested in planning, doing graduate work in this field and making several traffic surveys. He has been active in developing the work of the Kingston Town Planning Commission.

Professor Low joined the Institute as an Associate Member in 1929 becoming a Member in 1940. He has served as chairman and secretary of the Kingston Branch and has always been prominent in the branch activities being particularly interested in student members.

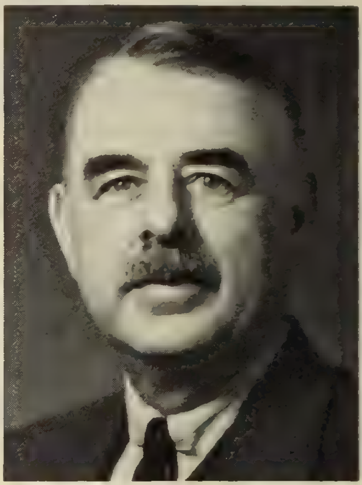
from 1908, in the western provinces as well as in Quebec. From 1920 until 1924 he was mine superintendent for Bennett-Martin Asbestos & Chrome Mines at Thetford Mines, Que. For the next eight years he was in charge of properties and all surveys in the Saguenay district for Price Brothers and Company Limited. Since 1932 he has been in private practice in Montreal as a consulting engineer and land surveyor.

Colonel Lindsay joined the Institute as a Student in 1908, becoming an Associate Member in 1919 and a Member in 1940. In 1944 he served as chairman of the Montreal Branch of the Institute and as president of the Corporation of Professional Engineers of Quebec.

R. A. Low, M.E.I.C.



W. L. Saunders, M.E.I.C.



C. C. Lindsay, M.E.I.C.

W. L. Saunders, M.E.I.C., has been elected councillor of the Institute representing the Ottawa Branch. Born at Goderich, Ont., he studied engineering at the University of Toronto. He was engaged in railway engineering from 1907 and in 1915 enlisted in the Canadian Expeditionary Force. He held the rank of lieutenant in the 6th Battalion of Canadian Railway Troops, serving in France from 1917 until 1919. For two years following his discharge he was employed as assistant engineer with the Canadian Pacific Railway in Saskatchewan on construction and maintenance. Since 1922 he has been with the Department of Highways of Ontario his present position being that of division engineer of the Ottawa Division.

Mr. Saunders joined the Institute as a Student in 1910, becoming a Junior in 1913, an Associate Member in 1920 and a Member in 1940. He has served as chairman of the Ottawa Branch.

C. C. Lindsay, M.E.I.C., is one of the newly elected councillors of the Institute for the Montreal Branch. Born in Quebec City, Que., he studied at the Quebec Commercial Academy and at McGill University, graduating from the latter with his B.Sc. in civil engineering in 1915. Following his graduation he served overseas for four years with the Royal Canadian Engineers and the Royal Engineers. While in the field he was promoted to acting major and was later confirmed to his rank. He was awarded the Military Cross and Croix de Guerre Belge. On his return from overseas he organized the Divisional Engineers for Military District No. 5 (Quebec) and subsequently went on the reserve of officers. He has now been made Honorary Lieutenant-Colonel of the Royal Canadian Engineers, M.D. No. 4, Reserve Army.

Colonel Lindsay has had extensive experience in all phases of land surveying and general engineering, dating

R. C. Flitton, M.E.I.C., is one of the newly elected councillors of the Institute representing the Montreal Branch. He graduated from McGill University with the degree of B.Sc. in 1914 and during the following year worked with C. H. Topp and Company as assistant on waterworks and mining surveys on Vancouver Island. In 1916 he joined the staff of the British Munitions Co. Ltd., Verdun, Que., on tool designing and was later assistant to the superintendent in the blending and proofing (powder) department, in charge of laboratory proofs, and assistant to the superintendent of the 18 pr. shell forging department. In 1919, after three months as sales engineer with the Williams Manufacturing Co. Ltd., Montreal, he was appointed assistant to the superintendent of the William Hamilton Company Ltd., Peterborough, Ont. He was subsequently engineer, chief engineer and works manager of the same company. He is at present employed as superintendent of industrial shops at Canadian Vickers Limited, Montreal.

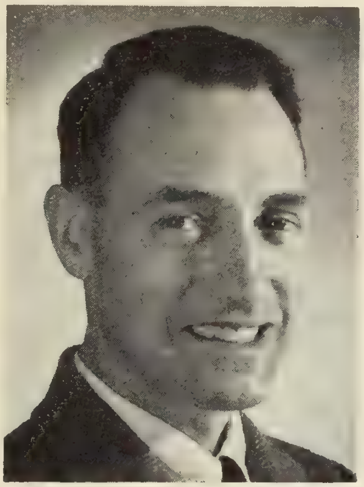
Mr. Flitton joined the Institute as a Junior in 1914, becoming an Associate Member in 1920 and a Member in 1940. For several years he served on the executive of the Peterborough Branch and was chairman of that Branch in 1929. He also served on the executive of the Montreal Branch.

Adam Cunningham, M.E.I.C., has been elected councillor of the Institute representing the Saguenay Branch. Born in Edinburgh, Scotland, he was educated at the George Watson College. After an apprenticeship in pattern shop, machine and erecting shops, he served with the West End Engine Works, Edinburgh, manufacturers of paper making machinery, and received technical training at the Heriot Watt College. In World War I he served with the R.A.S.C., Mechanical Transport, in the Egyptian Expeditionary Force. On returning to civil life he completed his apprenticeship and studied mechanical engineering at the University of Edinburgh, graduating with his B.Sc. with honours in 1923. From 1924-1936 he was employed as draftsman and mechanical engineer with Price Brothers and Company Limited at their Kenogami and Riverbend paper mills. After one year with the Ontario Paper Company Limited at Thorold, Ont., he returned to Price Brothers as plant engineer at Kenogami, Que., He was appointed chief engineer of the paper division last year.

Mr. Cunningham joined the Institute as a Junior in 1925, becoming an Associate Member two years later and a Member in 1940.

construction of the electric light system, Truro, N.S., and investigated and reported on a proposed hydro-electric development for Parrsboro, N.S. From 1915 until 1919 he was on active service in Palestine and France during which time he rose from the rank of lieutenant to that of major. After his return to Halifax in 1919 he joined the city engineer's staff and remained with the department until 1929 when he became manager of the Argyle Garage in Halifax. Major Doane was employed by the Standard Paving Wartime Limited at Halifax from 1931 until 1944 when he was appointed manager of the Halifax Public Utilities Commission.

R. C. Flitton, M.E.I.C.



A. Cunningham, M.E.I.C.

J. F. Wickenden, M.E. I.C.

J. F. Wickenden, M.E.I.C., is the newly elected councillor of the Institute representing the St. Maurice Valley Branch. Born in France, he received his primary education in the United States. In 1917-18 he served in France with the 23rd United States Engineers. He holds a certificate from the Université de France (Toulouse), 1919, and the following year he graduated from McGill University with the degree of B.Sc. Mr. Wickenden did some early work in Canada on surveys for the Geological Survey of Canada and with the St. Maurice Forest Protection Association. He was employed with the Barrett Company Limited from 1923 until 1925 when he was appointed Montreal representative of the Asbestos Manufacturing Company, Limited. In 1926 he started a general contracting business in Three Rivers, Que., and had it incorporated as a limited company in 1939. This firm of which he is president is known as the John F. Wickenden Co. Limited, general contractors and engineers.

Mr. Wickenden joined the Institute as a Junior in 1921, becoming an Associate Member in 1929 and a Member in 1940. He has served as chairman of the St. Maurice Valley Branch.

H. W. L. Doane, M.E.I.C., has been appointed to the Council of the Institute to represent the Association of Professional Engineers of Nova Scotia. Born in Halifax, N.S., he graduated from the Nova Scotia Technical College with the degree of B.Sc. in 1913. He also qualified as a Nova Scotia land surveyor. From 1912 until 1915 he was engaged in sewer design and construction at Springhill, Chester, Halifax, Lunenburg and Hazel Hill, N.S.; in waterworks design and construction at Kentville, Hazel Hill and Trenton, N.S., including the construction of a 1,000,000 gallon reservoir and attendant pipe lines. He assisted in the making of survey and the preparation of plans for and the engineering

Major Doane joined the Institute as an Associate Member in 1919 transferring to Member in 1923. He has been active in the Halifax Branch and has served before as a councillor of the Institute representing the Branch.

Earle 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. Born at Harvard, Mass., he graduated with the degree of Bachelor of Science in civil engineering from the Massachusetts Institute of Technology in 1914. After some time spent in following his profession he became instructor of highway engineering at the Polytechnic Institute of Brooklyn. During the last war, Professor Turner served as a second lieutenant in the Air Service of the United States Army. On his return to civilian life in 1919 he was appointed to the staff of the University of New Brunswick as professor of civil engineering.

Professor Turner joined the Institute as an Associate Member in 1920 transferring to Member in 1937.

A. A. Turnbull, M.E.I.C., has been elected councillor of the Institute representing the Saint John Branch. Born at Digby, N.S., he studied at Dalhousie University and at Nova Scotia Technical College, Halifax, from which he graduated with the degree of B.Sc. He has had much experience with hydro-electric construction, hydrographic survey and for 22 years has been working on telephone engineering and management. He is at present chief engineer of the New Brunswick Telephone Company Limited at Saint John, N.B. During World War I he served overseas as lieutenant in the 4th Battalion, Canadian Machine Gun Corps. At the outbreak of the present war he re-organized an

A. A. Turnbull, M.E.I.C.

N.P.A.M. Engineer Unit and went active as O.C. 1st (B) Fortress E. & M. Co., Royal Canadian Engineers. At the request of industry he was returned to civil occupation.

Major Turnbull joined the Institute as a Junior in 1920, transferring to Associate Member in 1926 and becoming a Member in 1940. He is a past-chairman of the Saint John Branch of the Institute and a past-president of the Association of Professional Engineers of the Province of New Brunswick.

Arthur E. Flynn, M.E.I.C., the newly elected councillor of the Institute representing the Halifax Branch, is professor in the department of mining engineering at the Nova Scotia Technical College. Born in England, he received his preparatory education in the United States but returned to England for specialized training at the Finsbury Technical College and the Royal School of Mines. By 1912 he had won his degrees, A.R.S.M. and D.I.C. His early professional experience was gained in England, Germany, and Spain. Then the development of Cobalt, Ont., attracted him to that district. While there, he designed and built the mining laboratory of the Haileybury School of Mines in which he was one of the first instructors. After two years spent in mining pyrites at Goudreau, Ont., and a year with the Hardinge Company at York, Pennsylvania, he was offered the chair of mining engineering at the Nova Scotia Technical College. His service to Nova Scotia has not been confined to teaching. For five years he acted as development engineer in the provincial Department of Natural Resources and in many other ways, notably by extensive research in the utilization of minerals, he has played an important part in developing the mineral industry of the province. He has contributed many invaluable papers and discussions on the subjects in which he is an authority.

A. E. Flynn, M.E.I.C.

Mr. Flynn joined the Institute as a Member in 1940. He is a past-chairman of the Halifax Branch.

INSTITUTE PRIZE WINNERS

Edward Phillips Fetherstonhaugh, M.C., M.E.I.C., Dean of the Faculty of Engineering and Architecture, University of Manitoba, Winnipeg, is one of the recipients for 1944 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 to Dean Fetherstonhaugh at the annual dinner is as follows:

"For more than twenty years Edward Phillips Fetherstonhaugh has been Dean of the Faculty of Engineering and Architecture at the University of Manitoba. During that time he has taken a leading part in the progress of engineering education in Canada, particularly in the regions west of the Great Lakes. His services to his country during World War I were recognized by the award of the Military Cross (1916) and by Mention in Despatches (1918). Keenly interested in establishing and maintaining the status of the engineering profession in Canada, he has been active in the affairs of The Engineering Institute of Canada and the Association of Professional Engineers of Manitoba.

"As a consultant, his services have been in request by governments, federal and provincial, and by municipal and public service authorities. As an outstanding electrical engineer he has been an active member of the National Research Council and has served on many of its working committees.

"An honours graduate of McGill University in 1894, he came to Manitoba in 1907, and during his long residence in the province of his adoption, has won the confidence and respect of his many students, his colleagues, and of the public. He has shown throughout that broad outlook which makes so strongly for national unity and progress. His achievements are now being recognized by the Council of The Engineering Institute of Canada by awarding to him a Julian C. Smith Medal."

John Armistead Wilson, M.E.I.C., Director of Air Services, Department of Transport, Ottawa, is one of the recipients of the Julian C. Smith Medal of the Institute for 1944. The citation which accompanies the award reads as follows:

"The technical branches of the Dominion Civil Service require for their operation and development a number of engineers who must possess, in addition to professional knowledge and experience, a full measure of organizing ability and foresight. John Armistead Wilson is an outstanding example of this type of Civil Servant. Born in Scotland, educated at St.

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

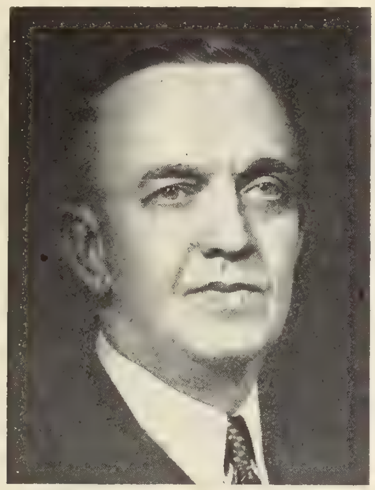
Andrews University, he entered the Department of Naval Service, then being formed, in 1910.

"His long service with the Dominion Government has covered the years during which aviation in Canada, at first based on the Civil Aviation Act of 1918 (which Mr. Wilson drafted), has grown from very modest beginnings to its present stature.

"After organizing the Canadian effort in connection with the Empire system of communication by airship, beginning in 1927, Mr. Wilson was largely concerned with the activities which led to the establishment of the Trans-Canada Airway and the construction of the necessary airfields, so that in 1937 it was possible to arrange for airmail, passenger and express services from coast to coast. In that year he became one of the Directors of Trans-Canada Air Lines Corporation, and later took charge of the Civil Aviation Branch, which, under his direction, has undertaken the construction of more than 200 airports for war purposes in Canada, Newfoundland and Labrador.

"In January 1941, Mr. Wilson was appointed Director of Air Services in the Department of Transport. Air transportation in Canada as it exists to-day owes much to his vision and energy during the long pioneer period. The Council of The Engineering Institute of Canada desires to mark the value of his services by the award of a Julian C. Smith Medal."


E. P. Fetherstonhaugh, M.E.I.C.


W. Griesbach, M.E.I.C.


James E. Gill

Walter Griesbach, M.E.I.C., chief engineer of the Foundation Company of Canada Limited, Montreal, has been awarded the Gzowski Medal of the Institute for 1944 for his paper "Construction of Shipshaw No. 2 Power Development" which appeared in the April 1944 issue of *The Engineering Journal.*

Born at Collingwood, Ont., he graduated from Queen's University with the degree of B.Sc. in 1912. Upon graduating he became attached to the Department of Public Works of Canada, and while with the department he was assistant engineer and resident engineer on breakwater construction and in charge of surveys of various harbours and rivers. He joined the staff of the Foundation Company of Canada Limited in 1918 as office engineer and became chief engineer of the company in 1928. Besides being responsible for all the engineering work in the construction of the Shipshaw power development, Mr. Griesbach has been closely associated with all work carried out by the company in the past fifteen years in the field of harbour construction, water power development, large bridge construction and industrial plant construction.

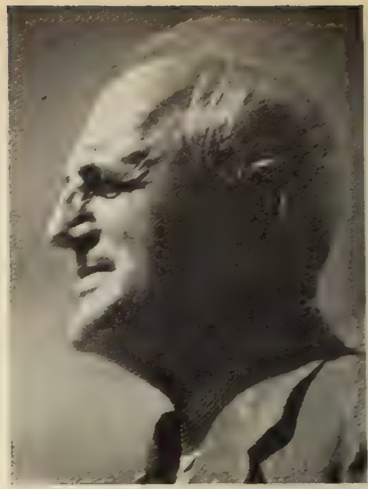
James E. Gill, Department of Geological Sciences, McGill University, Montreal, is one of the recipients of the Leonard Medal for 1944 for his paper "Zinc Deposits in the Federal Area" written jointly with Dr. P. E. Auger. Born at Nelson, B.C., he studied at the University of British Columbia. In 1921 he received his B.Sc. in mining engineering at McGill University and in 1925 his Ph.D. in geology at Princeton University. Dr. Gill was instructor and assistant professor at the University of Rochester, Rochester, N.Y., from 1925 until 1929. Since that date he has been assistant and associate professor at McGill University. His field experience included mining and geological work in many areas. From 1929 to 1936 he was a partner with W. F. James as a consultant. From 1936 to the present time Dr. Gill has been in general consulting practice on properties in various parts of Canada, Labrador, and the United States.

P. E. Auger, Bureau of Mines, Quebec, is one of the recipients of the Leonard Medal for 1944 for his paper "Zinc Deposits in the Federal Area" written jointly with Dr. J. E. Gill. Born at Ste-Croix de Lotbinière, Que., he received his degrees at the following institutions: B.A. at Laval University in 1929, B.Sc. in chemistry at Laval University in 1933, B.Sc. in geology at Queen's University in 1936, D.Sc. in geology at Massachusett's Institute of Technology in 1939. In 1933-34, Dr. Auger was instructor in physics and physical chemistry at Laval University and since 1939 has been geologist for the Quebec Bureau of Mines. In 1942 he became lecturer in economic geology at Laval University and in 1944 assistant professor of economic geology.

Wilfred Gallay, consulting chemical engineer, Ottawa, has been awarded the Plummer Medal for 1944 for his paper "Plastics in Engineering" as published in the February 1944 issue of *The Engineering Journal.* Born in Hawkesbury, Ont., and brought up in Calgary, Alta., he received his primary education in Calgary followed by normal school and two years of teaching in Alberta schools. He graduated from McGill University with degrees of Bachelor of Arts (first class honours in chemistry), Master of Science and Doctor of Philosophy. He was awarded the Moyse Travelling Fellowship and studied further at the University of Leipzig and the

P. E. Auger

W. Gallay



W. V. Sauer, M.E.I.C.

Kaiser Wilhelm Institute for Physical Chemistry at Berlin.

For twelve years up to July 1944, Dr. Gallay was head of the section on colloids and plastics of the National Research Council laboratories at Ottawa. He is now engaged in chemical consultant practice, specializing particularly in the field of plastics and related materials. He has published about 50 papers in various phases of theoretical and applied chemistry and is the inventor of several patented processes. He has lectured widely in Canada and the United States.

Max V. Sauer, M.E.I.C., is the first recipient of the Keefer Medal of the Institute for his paper "St. Lawrence River Control and Remedial Dams—Soulanges Section" which was published in the December 1943 issue of *The Engineering Journal.*

His graduation from Toronto University was followed by ten years of design and construction work in the Niagara Falls district with the Ontario Power Company and the Niagara Falls Power Company (Niagara Falls, N.Y.). During the latter part of this time he was mechanical engineer for the Ontario Power Company. This was followed by five years as engineer of design at Winnipeg on the construction of the Greater Winnipeg Water District Aqueduct. Another five-year period was spent as hydraulic engineer of design for the Hydro-Electric Commission of Ontario, during which period the Queenston and Nipigon developments were built. Following this he was hydraulic engineer for the Winnipeg Electric Company on the general layout and estimates for the Seven Sisters development. Mr. Sauer was hydraulic engineer of design on the Beauharnois development from its beginning, and later became hydraulic engineer and general superintendent of generating stations for the Montreal Light, Heat & Power Consolidated, which position he is now occupying with the Quebec Hydro-Electric Commission.

R. A. H. Hayes, M.E.I.C., acting chief engineer, Aluminium Laboratories Limited, Montreal, is the first recipient of the Ross Medal of the Institute for his paper "Electrical Equipment at Shipshaw", published in the April 1944 issue of *The Engineering Journal.*

A native of New Brunswick, Mr. Hayes is a graduate of Mount Allison and McGill Universities. He has been associated with engineering, design and construction of several hydro-electric plants in eastern Canada, on transmission line design and construction and power cable engineering. In 1938 he joined the electrical engineering department of Aluminium Laboratories Limited. When the urgencies of war created the need for rapid construction he transferred to the Aluminum Company of Canada to assist in the scheduling, expediting and co-ordination of the Arvida expansion. He later returned to Aluminium Laboratories as electrical engineer during the design and engineering of the Indian reduction plant in 1941. When Shipshaw became active, the Laboratories were responsible for the design and engineering of this power project and Mr. Hayes was

R. A. H. Hayes, M.E.I.C.

C. F. Morrison, M.E.I.C.

A. A. Hershfield, S.E.I.C.

appointed assistant chief engineer. In addition to this he assumed responsibility for the co-ordination of the complete undertaking and in this capacity made his contribution towards the record time in which the Shipshaw power development was brought into operation.

Carson F. Morrison, M.E.I.C., associate professor of civil engineering, University of Toronto, is the first recipient of the Canadian Lumbermen's Association Prize of the Institute for his paper "Modern Timber Engineering" which appeared in the October 1943 issue of *The Engineering Journal.*

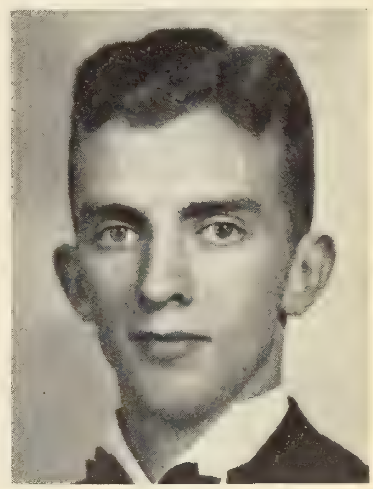
Born at File Hills, Sask., he attended the University of Saskatchewan graduating with the degree of B.E. (civil) in 1925. He studied further at McGill University and received his M.Sc. degree in structural engineering in 1927. During vacations he was with the Saskatchewan Department of Highways and the Dominion Bridge Company at Winnipeg and Toronto. Mr. Morrison was on the staff of the University of Alberta in 1927 leaving there the following year to join the staff of the University of Toronto. Since 1941 he has been doing consulting engineering work (structural) particularly in the timber engineering field. During summer of 1944 he was associated with the Forest Products Laboratories, Ottawa, on a research project concerning the use of glued laminated timber members in the general construction field.

André Leclerc, S.E.I.C., has received the Ernest Marceau Prize of the Institute for 1944 for his paper "Influence de la vitesse d'essai sur la résistance des matériaux". Born in Montreal, he studied the classical course at the College André Grasset, Montreal, graduating in 1939 with his B.A. degree with honours. He then studied engineering at the Ecole Polytechnique of Montreal where he graduated in 1944 with the highest honours. He received the Lieutenant-Governor's medal for heading his class throughout the course as well as the medal of the Ecole Polytechnique Alumni. Upon graduation he joined the staff of the Dominion Rubber Company Limited in the industrial engineering department at St. Jérôme, Que., where he is now plant chemist.

André Leclerc, S.E.I.C.

Allan A. Hershfield, S.E.I.C., is the recipient of the John Galbraith Prize of the Institute for 1944 for his paper "Plywood: A Structural Material for Aircraft". Born at Winnipeg, Man., he attended high school there and entered the University of Toronto in 1940, graduating in 1944 as a Bachelor of Applied Science in mechanical engineering. During the summer of 1943 and 1944 he worked on the engineering staff of Massey-Harris Co., Limited (aircraft division), Weston, Ont., on the famous "Mosquito" Bomber contract. It was during that period that he became interested in plywood and its uses. On graduation he entered the employ of Canadair Limited of Montreal in the aircraft design office and was transferred by them last November to Douglas Aircraft Co. Inc. of Santa Monica, California, for an indefinite period of training.

James L. Belyea, S.E.I.C., is the recipient of the Martin Murphy Prize of the Institute for 1944 for his paper "The Cathode Ray Oscillograph and its Applications in Industry". Born at Saint John, N.B., he attended Saint John High School, winning the City Corporation Gold Medal and the Lord Beaverbrook Scholarship on matriculation. During summer vacations he was engaged by the New Brunswick Electric Power Commission, Saint John Dry Dock & Shipbuilding Co. Ltd., and as an instrumentman with the airways Branch of the Department of Transport. He graduated from the University of New Brunswick in 1944 and is now in the Royal Canadian Navy. This is the second consecutive year that Mr. Belyea has been the recipient of this award.



J. L. Belyea, S.E.I.C.

ANNUAL FEES

Members are reminded that a reduction of one dollar is allowed on their annual fees if paid before March 31st of the current year. The date of mailing, as shown by the postmark on the envelope, is taken as the date of payment. This gives equal opportunity to all members wherever they are residing.

News of the Branches

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

EDMONTON BRANCH

G. H. Milligan, Affil.E.I.C. - *Secretary-Treasurer*

The general meeting of the Edmonton Branch was held in the Medical Building, University of Alberta, on January 18th, 1945.

This meeting was held in conjunction with the Refresher Course in Soil Mechanics and Concrete Testing being carried on at the University, and those attending the course were visitors at the meeting. Approximately 25 members and 125 visitors were present.

The chairman of the Edmonton Branch, B. W. Pitfield, opened the meeting welcoming the visitors to the Branch. Professor I. K. Morrison was called on to introduce the speaker of the evening, Dr. N. McLeod of the Asphalt Division of the Imperial Oil Company. Professor Morrison mentioned that Dr. McLeod was a graduate of the University of Alberta in chemical engineering, had obtained his Master's Degree in chemistry at the University of Saskacthewan, and his Doctor's degree in civil engineering at the University of Michigan.

Dr. McLeod opened his address by illustrating with a map the route of three highways over the Andes in Peru, over which he had travelled and taken coloured films. After a few remarks regarding the conditions in the country, Dr. McLeod showed the films and carried on a running commentary as they were shown. Among other things of interest were the almost insurmountable mountain passes through which the highway had been built, and the extremes in temperature within very short distances due to the rapid change in elevation attained by the highway. The speaker also mentioned the Inca and Pre-Inca civilizations, traces of which were amply illustrated by the films, and gave a short archaeological background for these. Altogether three reels of films were shown and it is felt that they were among the most interesting pictures of this sort seen by the Branch.

Dr. McLeod was tendered a vote of thanks by Professor R. G. Hardy, and the meeting adjourned to the University cafeteria where refreshments were served.

HALIFAX BRANCH

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

The annual combined banquet of the Halifax Branch of the Institute and the Association of Professional Engineers of Nova Scotia was held at the Nova Scotian Hotel on January 18. A total of 227 attended this function. L. E. Mitchell, chairman of the Halifax Branch of the Institute was chairman for the first section of the meeting and J. R. Kaye, president of the A.P.E.N.S., for the second part.

During dinner orchestral selections were enjoyed, as were several songs sung by everyone present.

Guests at the head table were: Colonel F. W. W. Doane, a senior member of the E.I.C. and A.P.E.N.S.; Professor C. C. Coffin, representing the Chemical Societies; Mr. J. H. Whitford, president of the Nova Scotia Architectural Society; Mr. S. A. Willis, vice-president Nova Scotia Mining Society; Dr. C. B. Weld, representing the Nova Scotia Institute of Science; Mr. S. W. Gray, secretary-treasurer of E.I.C. and A.P.E.N.S.

After making a presentation of honorary life memberships to J. S. Misener, L. H. Wheaton, J. H. Winfield, and C. H. Wright, Mr. Kaye then introduced the guest speaker, J. A. Hanway, K.C., chairman of the Nova Scotia Board of Public Utilities.

Mr. Hanway paid a fine tribute to the engineers before he told, in his own inimitable way, of some of his early experiences as a young lawyer.

K. L. Dawson was master of ceremonies for the entertainment that followed. Harry Cochrane provided a splendid programme of entertainment consisting of singing, dancing and excellent specialties.

In conclusion the Master of Ceremonies expressed thanks to the Banquet Committee, and also to the following firms who helped to make this one of the best joint banquets ever held: Canadian Westinghouse Co. Ltd., Foulis Engineering Sales Ltd., Foulis & Bennett Electric Ltd., Imperial Oil Ltd., D. C. Keddy, Moloney Electric Co. of Canada Ltd., National Iron Corporation, W. H. Noonan, Northern Electric Co. Ltd., Nova Scotia Light & Power Co. Ltd., Wm. Stairs Son and Morrow Ltd.

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The regular monthly dinner meeting of the Halifax Branch was held at the Nova Scotian Hotel on Thursday, February 22, 1945. The attendance was 76 and included several students of the senior class of the Nova Scotia Technical College who were guests of the Branch.

Chairman L. E. Mitchell, introduced the special guests and the speaker of the evening, Edward D. Brown, plant superintendent of Canadian Industrial Minerals Limited, at Walton, N.S.

Mr. Brown's subject was **Steep Rock Lake Pumping.** Since Mr. Brown was mechanical and electrical superintendent at Steep Rock Iron Mines he was exceptionally well qualified to speak on such a topic. With the aid of blackboard illustrations and sketches, he first talked on the general aspects of the job and then covered the pumping operations in detail. Following this he showed a very enlightening colour film of the project. Both the film and the talk were very much enjoyed by all present. Keen interest was in evidence throughout, especially when Mr. Brown described how the numerous difficulties were overcome.

H. F. Ryan moved a hearty vote of thanks to Mr. Brown for his willingness and co-operation in the giving of his time for a very instructive evening for those in attendance. This motion was seconded by J. P. Messervey. The applause which followed indicated in no uncertain terms that Mr. Brown had done an excellent job.

The meeting was concluded by the showing of a technicolour sound film entitled **The Life Line of the Nation** which portrayed the role of the American railroads in wartime.

HAMILTON BRANCH

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

The annual meeting and dinner of the Hamilton Branch was held on Thursday, January 11, at the Scottish Rite Club, with sixty-six members and guests in attendance; H. A. Cooch, retiring chairman, presided.

At the conclusion of the dinner W. E. Brown, secretary-treasurer, reported on the activities of the Branch throughout the year. R. J. Schofield presented the report of the Nominating Committee, the new executive being announced as: Chairman—Norman Eager, Vice-Chairman—A. R. Hannaford, Secretary Treasurer—W. E. Brown, Councillor—Alex Love, Executive Committee— H. J. A. Chambers, E. T. W. Bailey, E. G. Wyckoff and G. L. Vollmer.

Alex Love outlined to the assembly the decision of the Institute to impose a voluntary levy of $2.00 for the purpose of raising funds for secretarial assistance in connection with rehabilitation work.

The speaker of the evening, Dean C. R. Young, head of the Faculty of Applied Science and Engineering at the University of Toronto, was introduced by H. J. A. Chambers.

Dean Young spoke on **Trends in Engineering Education.** From his long experience and observations in the field of engineering education, Dean Young noted that a relatively small percentage of engineering graduates followed their chosen profession throughout life. A large proportion forsook engineering for administrative, economic and commercial positions. While such statistics indicated that an engineering education forms an excellent background for numerous other fields of endeavour, Dean Young felt that even greater advantages would accrue from an increase in the time allotted to liberal arts subjects.

Such a change forms the basis of major trends in engineering education to-day. While curricula at the University of Toronto had formerly devoted only six per cent of study time to liberal phases, plans were afoot for a reduction of strictly technological training to 71 or 72 per cent. A course of liberal arts study in such subjects as modern economics and political trends has been introduced and enthusiastically received by students, Dean Young stated.

"The well-rounded professional man must be able to use English correctly and effectively." The importance of such training had not been overlooked in composition of modern curricula for engineering schools.

Dean Young observed that the majority of notable developments in the last few years were directly traceable to physicists. A great need was felt for small selected groups of competent engineering students to undergo intensive scientific training in order to keep pace with such advanced developments.

At the conclusion of Dean Young's talk, a vote of thanks was moved by E. R. Eaton.

H. A. Cooch, retiring chairman, handed over the gavel of office to his successor, N. Eager, who conducted the remainder of the meeting. Neil Metcalf moved a vote of thanks to the outgoing officers and executive.

MONTREAL BRANCH

L. A. Duchastel, m.e.i.c. - *Secretary-Treasurer*
Hyman H. Schwartz, s.e.i.c. -
Eli L. Ilovitch, s.e.i.c. - } *Branch News Editors*

The activities of the Montreal Branch were reviewed by its retiring chairman Lieut.-Col. C. C. Lindsay at the annual business meeting held on Thursday evening, January 26th. He paid high tribute to the various committees for their efforts in making the past year so successful,, and especially to those who helped arrange the agreement between the Quebec Corporation of Professional Engineers and the E.I.C.

At the conclusion of his speech Col. Lindsay called upon John B. Stirling, the newly elected chairman, to take over his office. Other officers elected were: J. A. Beauchemin, vice-chairman; J. J. H. Miller, G. N. Martin, D. Anderson and C. C. Lindsay. Others on the executive committee whose terms of office expire next year are M. S. Macgillivray, J. Benoit and L. H. Burpee. L. A. Duchastel continues as secretary-treasurer.

The highlight of the evening was an address given by de Gaspé Beaubien, C.B.E., president of the Institute. He discussed the conditions which he observed during his trans-Canada tour. Mr. Beaubien told the members that the industrial progress, since the outbreak of war, has been tremendous in this country, not only in the quantity of items produced, but in their high quality and low cost. Many articles, materials and new techniques for the manufacture of old articles have been developed in Canada. The appearance and efficiency of our factories are comparable to the best in the world.

In concluding his remarks Mr. Beaubien praised the fine relations, trust, understanding, and mutual respect that exists between labour and engineers. For this reason, and because of the necessity of maintaining full production now and in the port-war era, the speaker called upon engineers to take an even greater interest in public affairs and in the education of their fellow citizens.

Col. Lindsay thanked the speaker for his timely and interesting address.

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The 12,500 K.W. Steam Electric Station of the Nova Scotia Light & Power Co. Ltd. was the subject of a paper presented by J. T. Farmer and J. W. MacDonald before the Montreal Branch on Thursday evening, February 1st, 1945.

Mr. Farmer spoke first on the necessity for building this plant during the war period. He pointed out that it was only because there were no new hydro-electric power development sites available in the area that the project was carried out. Now it is possible to use more of the water storage without the risk of not having enough water left to generate needed power.

A series of slides was shown, along with a running commentary, by J. W. MacDonald. Mr. MacDonald was resident engineer on the job and was able to take photographs illustrating the different stages of construction. Those present were shown pictures of the cribwork and how it was laid in place. Among the other interesting slides was one depicting a section of the station showing the process from delivery of coal to production of kilowatts.

A discussion period followed. C. D. Bailey, was chairman of the meeting at which there were 75 members present.

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A lecture on diesel-electric rail cars and locomotives for general railway and industrial yard use was given to the Montreal branch by Ira I. Sylvester on February 8th. Mr. Sylvester discussed the machinery that goes into diesel-electric locomotives and the problems of design that each unit entails. With the aid of charts and graphs, he showed how the high efficiency, long hours of availability, low operating and service costs are creating ever increasing demands for diesel electrics.

Diesel-electric locomotives in the 2,000 h.p. plus class have definitely established a place for themselves in the long range transportation field, the speaker stated, and are giving steam locomotives strong competition. However in 300 to 1,500 h.p. yard-locomotive class, the diesel-electrics rule supreme, practically eliminating all orders for steam locomotives.

An interesting discussion of the problems of diesel-electric operation followed the meeting, which was presided over by H. F. Finnemore.

Illustrated copies of the lecture may be obtained by writing to I. I. Sylvester, Canadian General Electric Company, Montreal.

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The Manufacture of Beet Sugar was the lecture given to the Montreal Branch on Thursday evening, February 15, 1945, by Mr. Marshall R. Allen, General Manager of the Quebec Sugar Refinery, St. Hilaire.

After mentioning a few of the construction problems involved, the audience was given a verbal picture of the process from the raw beets to the finished sugar. The factory has four floors above the ground floor and most of the operations flow through process by gravity. Since the process equipment for the whole factory is synchronized, it is in the slicing room on the third floor that the controls are located for regulating the production of the factory.

The beets are washed and sorted after which they are sliced and weighed in batches for further processing. The pulp is then passed through a continuous diffusion battery for extraction of the raw juice which is passed through various tanks and filters for further processing. In the final operation, the sugar is granulated after which it is stored for packing and distribution.

Mr. Allen mentioned that it is possible to produce crystals of any size and that he personally had made a crystal as large as his fist. Every ton of beets yields about 250 pounds of sugar, 90 pounds of molasses and about 100 pounds of pulp which is used as livestock feed. The speaker mentioned that it is impossible to tell the difference between cane and beet sugar, and of last year's world production of 30 million tons, 19 million were cane and 11 million tons were beet sugar.

There were 130 present at the meeting.

Junior Section

"The success of our organization, The Engineering Institute of Canada, depends entirely on the generous and voluntary contributions of time and good-will from our members and our too small a staff," said Jack Sylvester, retiring chairman of the Junior Section of the Montreal Branch, at the annual meeting held on January 29th with an attendance of more than 100. After his welcome address he called on R. A. Frigon to read the minutes of the previous annual meeting.

The following members slated by the nominating committee for 1945 were elected by acclamation: R. A. Frigon, chairman; A. Gervais, vice-chairman; T. S. McMillan, secretary. The results of the election held for councillors are as follows: P. E. Salvas, J. M. Rousseau, J. E. Brett.

A most interesting film entitled **Bridging San Francisco Bay** was presented. From the sinking of the foundations of the towers to the construction of the suspended portion and of the cantilever span arc, the audience, composed mostly of students, admired the courage and skill of the bridge erectors.

Albert Clement reported on the progress accomplished by the Committee for the Welfare of the Young Engineer. This committee is at present busy with collective bargaining. R. A. Frigon, chairman of the Committee on the Development of the Young Engineer, told the audience that courses in calculus and soil mechanics have been organized.

Thanking everyone for the support and encouragement extended to him during his term of office, Jack Sylvester, retiring chairman, called on R. A. Frigon to take the chair and proceed with the meeting. A few words by the new chairman ended the evening's official business. Refreshments were served.

OTTAWA BRANCH

C. G. Biesenthal, Jr. e.i.c. - *Secretary-Treasurer*
R. C. Purser, m.e.i.c. - - *Branch News Editor*

On the evening of January 31, 1945, at the invitation of W. B. Timm, director of the Mines and Geology Branch of the Bureau of Mines, members of the Ottawa Branch visited the new physical metallurgical research laboratories.

W. L. Saunders, past-chairman of the Ottawa Branch of the Institute, opened the meeting after which Dr. G. S. Farnham, chief metallurgist, spoke briefly on the part the laboratories are playing during the war. He also emphasized their post-war role in assisting Canadian industry to keep abreast of technical developments in other countries.

* * *

At a noon luncheon on February 14, 1945, Huet Massue of Montreal, gave an address on **The Heating of Dwellings.** Mr. Massue, who is statistical engineer of the Shawinigan Water and Power Company, explained that the heating of Canadian homes by electricity is not yet practically and economically feasible under present known and proved methods. However, he told the meeting that research is being carried on by many power companies and divisions of government along these lines.

The electric heating of private dwellings would increase the power requirements of retail customers about tenfold. In the case of many provinces, power required to heat homes would exceed even the entire potential power resources of the province. Moreover, by present heating methods, cost of installation of electrical heating equipment in a house would almost equal the total cost of the house itself.

Generalized electric heating would require rates altogether too high for the ordinary house owner to pay. As time went on more and more electricity would be used for heating but it would only be as auxiliary to coal, oil, or gas. Some homes in the immediate vicinity of power plants have been entirely heated by electricity, but these are experimental rather than practical. Factors against it were the magnitude of the power requirements, the investment needed to bring the power to the consumer's premises, the limited time during which the full capacity of the installation would be used, and the high cost of heating which would result.

QUEBEC BRANCH

Leo Roy, m.e.i.c. - - - *Secretary-Treasurer*
Roger Desjardins, Jr.e.i.c. - *Branch News Editor*

Le 18 décembre 1944, le maire de Québec reçut les membres de la Section de Québec dans la salle du conseil municipal. L'assistance se composait de soixante-huit membres.

A cette occasion, le maire exposa à la section les projets d'amélioration que la ville de Québec a préparés pour lui permettre de maintenir chez elle, après la guerre une activité économique susceptible d'assurer à la population des conditions de vie raisonnables.

Son Honneur le maire, développa plusieurs idées démontrant la nécessité urgente de la construction d'habitations ouvrières qui devrait se faire immédiatement après la guerre. Il exposa le projet de maisons à multiples logements où les loyers seraient à un prix abordable pour les ouvriers. Son Honneur fit aussi un exposé substantiel des principaux projets d'après-guerre suivants:

1. Réalisation d'un port franc pour la ville de Québec et établissement d'une zone industrielle.
2. Eclusage de la rivière St-Charles et détournement des rivières Lairet et St-Michel.
3. Elimination des traverses à niveau et construction de ponts.
4. Prolongement de boulevards existants jusqu'aux limites de la cité.
5. Construction d'une usine principale de pompage pour l'égout collecteur.
6. Construction de routes pour dégager le quartier populeux du centre de Québec.

* * *

Le 15 janvier 1945, monsieur Joseph Risi, docteur ès-sciences, professeur de chimie organique à la Faculté des Sciences à l'Université Laval donna aux membres de la section une causerie intitulée: **Le bois comme matériau d'ingénieur.** L'assistance se composait de 58 membres.

Le Dr Risi démontra que le bois n'avait pas été utilisé à sa pleine capacité avant la guerre, mais, depuis cette période, la rareté des métaux a forcé les nations mondiales à lui trouver des qualités jusque-là inconnues. A l'heure actuelle, il existe plusieurs méthodes permettant l'amélioration permanente des propriétés du bois. Le Dr Risi nous exposa les procédés modernes pour obtenir:

1. Le bois pressé en direction perpendiculaire aux fibres.
2. Le bois laminé au moyen d'adhésifs spéciaux résistant à l'eau.
3. Le bois imprégné obtenu en traitant le bois dans l'autoclave avec substances ignifuges.
3. Le bois imprégné obtenu en traitant le bois dans l'autoclave avec substances ignifuges.
4. Le bois comprégné obtenu en appliquant à chaud sur le bois laminé et imprégné une forte pression hydraulique provoquant une résinification totale au sein des fibres de bois.
5. Le papier comprégné, procédé semblable au précédent appliqué au papier.
6. Le contreplaqué moulé, matière pour la construction navale et aéronautique.
7. Divers produits forestiers plastiques en appliquant l'une des méthodes de résinification précédente aux déchets forestiers, sciures de bois et autres.

Selon le procédé employé, on obtient un bois pratiquement incombustible, ou résistant aux insectes et aux pourritures, ou résistant à l'eau, l'humidité, acides et bases diluées, ou du bois très dense et très dur se travaillant bien à la machine, ou du bois dont les qualités mécaniques, poids pour poids, surpassent même celles des métaux légers. A la fin de sa conférence, le Dr Risi fit voir de nombreux échantillons préparés en partie au laboratoire des produits forestiers à Ottawa, en partie au laboratoire du Ministère des Terres et Forêts de Québec, à Duchesnay.

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Le 22 janvier 1945, le président de l'Institut, M. de Gaspé Beaubien, rendit visite à la section de Québec.

Au cours de l'après-midi, M. Beaubien visita la Faculté des Sciences de l'Université Laval. Il y rencontra le personel de la faculté et les étudiants, à qui il adressa la parole. Le soir, le conseil et les membres le reçurent à un diner au Club de la Garnison. Invité à dire quelques mots, M. Beaubien fit part des impressions reçues lors de sa visite aux différentes sections de l'Institut, reparties par tout le Canada. Il insista surtout sur le fait que l'ingénieur peut, par sa formation, aider à concilier les intérêts des ouvriers et des patrons, ayant la confiance des deux groupes. Il recommanda à l'ingénieur de s'extérioriser davantage pour faire valoir son point de vue. M. Louis Trudel résuma les activités de l'Institut durant l'année écoulée. M. A. R. Décary adressa aussi la parole.

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On Monday, January 29th, Mr. R. Dupuis, past-chairman of the branch, presented Mr. H. N. Bronson who gave an address entitled **Training—Yesterday, To-day and To-morrow.**

After describing briefly the past and present practices used for training, Mr. Bronson discussed the problems that will confront the industry in that field.

It is one of the duties of industry to proceed with a carefully planned training programme. Only by training will it be sure to acquire a competent personnel and future supervisors. This training programme must be such that it gives an even chance to all employees.

The speaker discussed the role of the supervisors in this training programme. He then pointed out the importance of tables, forms, reports to be made by the foremen. Photos or films are a good way to help train employees and to prove one's points. Mr. Bronson asked Mr. Armstrong, a training supervisor of the B.T.Co. to show the audience two short films on training.

Mr. L. Buteau expressed on behalf of the audience their thanks to the speaker.

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Le 12 février 1945, la Section de Québec avait le plaisir d'avoir comme conférencière, mademoiselle Rachel Audet, éclairagiste de la Compagnie Quebec Power. Cent trente-cinq personnes assistaient à la réunion.

La conférence de mademoiselle Audet avait comme titre: **Divers aspects de l'éclairage domestique.**

La conférencière exposa l'importance d'une filerie adéquate et d'un bon éclairage électrique pour la maison moderne. Les scientistes ont prouvé que le fait de voir et celui de mieux voir dépend de plus ou moins de lumière. Grâce à l'illuminomètre, on peut, en se basant sur des spécifications établies par des experts, recommander telle ou telle quantité de lumière artificielle pour telle ou telle tâche usuelle. La conférencière fit ressortir les nombreux avantages d'une bonne illumination en plus d'une quantité suffisante de lumière. Elle exposa un grand nombre de moyens pour arriver à cette fin: abat-jour et diffuseurs permettent de masquer les sources lumineuses et de faire converger une partie des rayons vers le plafond des appartements en donnant une meilleure réflexion de la lumière vers les objets à éclairer. Une bonne illumination peut être considérée comme une des nécessités fondamentales de la vie quotidienne et met en valeur les meubles, les tentures, les boiseries et tous les accessoires décoratifs d'une maison. Une filerie adéquate évite un nombre incalculable d'ennuis et conséquemment coûte moins cher. Un bon éclairage aide et protège la vue tout en diffusant une lumière qui, bien qu'artificielle, s'apparente quelque peu à l'illumination gaie et riante du soleil.

Mademoiselle Audet nous fit voir une série de projections lumineuses où on comparait les pièces mal éclairées de différentes maisons avec les mêmes pièces améliorées, grâce à un bon éclairage. La conférencière donna les commentaires appropriés à chacune des vignettes. Une seconde série de projections illustra l'emploi d'une illumination adéquate dans différentes nouvelles constructions pourvu d'un éclairage artificiel idéal. La conférencière expliqua avec détails les moyens employés pour obtenir dans chaque cas l'illumination artificielle suffisante.

SAINT JOHN BRANCH

L. O. Cass, M.E.I.C. - - *Secretary-Treasurer*
G. W. Griffin, M.E.I.C. - *Branch News Editor*

The annual joint supper meeting of the Saint John Branch of the Institute and the Association of Professional Engineers of New Brunswick was held in the Admiral Beatty Hotel on January 25th. Eighty members and guests were in attendance to hear a talk on **Shipshaw** given by R. A. H. Hayes, assistant chief engineer of Aluminium Laboratories Ltd., Montreal.

The joint supper followed the annual meeting of the Association at which officers for the coming year were elected. C. D. McAllister, chairman of the branch, who presided at the supper, announced the officers elect as follows: A. S. Gunn, Moncton, president; G. M. Brown, Saint John, vice-president; E. C. Percy, Moncton, R. M. Richardson and C. G. Clark, both of Saint John, new members of council.

The chairman announced that, because of ill-health, C. C. Kirby found it necessary to relinquish the duties of Treasurer-Registrar of the Association and had tendered his resignation after five years in office.

A toast to the Institute was proposed by F. P. Vaughan and responded to by A. A. Turnbull. The toast to the Association was proposed by the new president, A. S. Gunn and responded to by Prof. E. O. Turner.

Mr. Hayes, with the aid of lantern slides and moving pictures, covered the history and development of Shipshaw from start to finish. After dealing briefly with early efforts to develop power in the vicinity of Shipshaw he proceeded to explain the gigantic hydro-electric development as it stands to-day and gave many interesting figures regarding it. Speaking of the excavation, he said that there had been a total earth excavation of 3,225,000 cubic yards and 2,620,000 cubic yards of rock removed to make way for the construction of the various works.

In order that these huge quantities of materials might be made available to the power shovels it was necessary to use 3,260,000 pounds of dynamite and the total rock drilling to accommodate the explosive equalled 840 miles.

Other interesting figures given by the speaker included over eight million cubic yards of concrete which was reinforced with 8,000 tons of reinforcing steel. The combined capacity of the various mixing plants was 6,500 cubic yards per day. Into these mixers 10 to 25 carloads of cement went daily together with the output of rock crushing plants with a daily capacity of 8,000 tons. As much as 30 million feet of lumber was used on the project. The average number of men working daily on the construction was 3,960, the peak number employed being close to 10,000. To maintain the necessary labour meant a turnover of nearly 50,000 men. The quantities of food required to feed the workers were tremendous and called for batteries of butchers, cooks and waitresses in order to provide a constant supply of meals for the employees, Mr. Hayes reported.

A vote of thanks to the speaker was moved by G. A. Vandervoort and seconded by G. G. Murdoch.

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The potential valuable asset which New Brunswick has in her forests was portrayed by Dr. C. P. Burchill, president of The New Brunswick Forest Products Association, when he addressed a meeting of the Saint John Branch in the Admiral Beatty Hotel on February 15th. Dr. Burchill was introduced by C. D. McAllister, chairman of the Branch.

"Vigilance and eternal vigilance," was the keynote stressed by the speaker in expressing the belief that the citizens of not only New Brunswick but other parts of the Dominion were as yet not sufficiently aroused on the vital matter of forest conservation.

In stressing vigilance, Dr. Burchill was referring to what he called the problem of the future, that of preservation of the forest lands, as follows: Intelligent and profitable utilization of our forest lands, control from fire and insects and proper forest management.

Speaking of the New Brunswick forests, the speaker said that the province would have to bear the consequences if forest products were allowed to dwindle away. Timber on approximately 75,000 acres was being lost annually as a result of forest fires, he stated. Many of these fires were undoubtedly caused by lightning and he advocated that a broad system of forest roads be considered to eliminate much of the delay encountered in getting forces to the scene of the fires after discovery.

"Insects are also responsible for a great amount of our timber loss," Dr. Burchill pointed out. "Recent figures reveal that about 70,000 cords of pulpwood timber alone are destroyed by insects each year. This amazing total is sufficient to supply pulp mills of this province, at their present rate of production, for the next 100 years."

Reviewing the part wood had played in the war, Dr. Burchill voiced the opinion that, "it had saved the day." As a measure of its importance Germany had considered it more necessary than oil as evidenced by the plans that country had made to gain control of the world's forests, the speaker declared as he spoke of the pre-war wood crusade activities carried on in Czecho-Slovakia, Norway, Roumania, Jugoslavia, Russian occupied Poland, Latvia and later Russia. Germany had acquired a network of forest and timber plants throughout Europe and had then attempted the same policy on this continent with the view to making wood the raw material on which Hitler planned to found the Nazi world hegemony, he said.

The further importance of wood was emphasized by the speaker in enumerating only a few of the great variety of uses found for wood during the war. These products, he said, included explosives, rayon, cellophane, plastics, plywood for all purposes and in the production of the famous Mosquito aircraft.

Dr. Burchill concluded his talk with the declaration that New Brunswick has a valuable asset in her forests and exhorted that the wealth be developed for the use of the future. C. C. Kirby thanked the speaker for his interesting talk.

As a fitting and appropriate conclusion to the address two films were shown. They were entitled **To-morrow —Timber** and **Lifeline of the Nation,** the latter depicting the vital part the railroads play in the existence of a nation at war.

SASKATCHEWAN BRANCH

Stewart Young, M.E.I.C. - *Secretary-Treasurer*

The regular monthly meeting of the Saskatchewan Branch of the Institute with the Association of Professional Engineers was held in the Kitchener Hotel, Regina, on Friday evening, January 19, 1945. The meeting was preceded by a dinner at which the attendance was 35.

Immediately following the meeting two films were shown, entitled respectively, **Radio Front Line** and **The Strategy of Materials.**

The twenty-eighth annual meeting of the Saskatchewan Branch was held in the Hotel Saskatchewan, Regina, on Friday, February 16, 1945, at 3.00 p.m. with an attendance of 22. After welcoming the members, Chairman J. McD. Patton, called for the minutes of the last annual meeting on February 18, 1944, and a special general meeting on May 19, 1944. These minutes, on motion of D. A. R. McCannell and H. I. Nicholl, were confirmed.

The secretary presented the report of the Executive to December 31, 1944, showing a total membership of 227 and a bank balance of $26.24. The report was adopted on motion of J. G. Schaeffer and H. S. Carpenter.

H. I. Nicholl, convenor of the Papers and Meetings Committee, presented the report of his committee, which also functions for the Association of Professional Engineers. The report was received, on motion of F. C. Christie and F. H. Smail, with expressed appreciation and thanks to the committee for their work during the past year. Six meetings were held with an average attendance of 46.

The report of the Saskatoon Section, showing six meetings held with an average attendance of 47, was presented by N. B. Hutcheon and adopted, on motion of D. A. R. McCannell and J. W. D. Farrell. It was noted that the average attendance in Saskatoon was greater than in Regina.

D. A. R. McCannell reported for his committee on Student Guidance, stating that the activities of the committee had been enlarged to include representatives of most of the branches of engineering.

SAULT STE. MARIE BRANCH

T. F. Rahilly, Jr.E.I.C. - *Secretary-Treasurer*

A general meeting of the Branch was held at the Algo Men's Club, Bay Street, on the evening of Friday, February 2, 1945, when members of the Branch were dinner guests of the Algoma Steel Corporation, Ltd. After the dinner a paper entitled **Beam and Column Design** was presented by W. H. M. Laughlin, chief designing engineer, Ontario Division, Dominion Bridge Company, Toronto.

The paper stressed particularly the advantages of wide flange beams over the conventional "I" Beams when used as beams or columns. The talk was illustrated by lantern slides. Mr. Laughlin also had with him and demonstrated an S.R.-4 portable strain indicator and strain gauge which can measure strains in a structural member as low as one millionth of an inch.

Twenty-seven members of the Branch were present. Sixty people were at the dinner and seventy attended the meeting. G. W. MacLeod acted as chairman.

TORONTO BRANCH

S. H. deJong, M.E.I.C. - *Secretary-Treasurer*
G. L. White, Affil.E.I.C. - *Branch News Editor*

At the joint meeting of the Toronto Branch of the Institute with the Toronto Section of the A.I.E.E. on Friday, January 26th, A. Frampton, Hydro-Electric Power Commission of Ontario, presented a paper on **The New T.V.A. Hydro Plants-Mechanical and Electrical Features** by H. J. Petersen, head mechanical design engineer, and R. A. Hopkins, head electrical engineer, both of Design Department, Tennessee Valley Authority, Knoxville, Tennessee.

Watts Bar Dam

The paper discussed two of the Tennessee Valley Authority projects deemed typical in many respects of the new plants designed and constructed by T.V.A. The Watts Bar Dam was selected as exemplifying the main river, low head plant. Located on the Tennessee River some 128 river miles below Knoxville, it has a drainage area of 17,310 square miles, 400,000 cfs being the maximum recorded flow, and was designed for a maximum flow of 550,000 cfs and for a total storage of 1,132,000 acre feet. The 2,490 ft. long and 97 ft. high dam has a concrete spillway section, a concrete non-over-flow section and at one end an earth embankment. Discharge over the spillway is controlled by 23 radial gates, each 40 ft. wide by 32 ft. high. The five turbines are each rated 42,000 hp. at 52 ft. head at 94.7 rpm. They are designed to yield best efficiency under a 57 ft. head and are built to operate under a maximum head of 63 ft. Turbine guarantee includes deliverance of 30,000 hp under a minimum head of 40 ft. The turbines are of the Kaplan adjustable-blade propeller type with runners 19′ 6″ diameter. Four of the Watts Bar generators are connected by pairs to two transformer banks with 15 kw. 1,000,000 kva. breakers and one generator to an individual transformer through a motor operated disconnect. Three phase transformers have been used for straight two winding transformations and are rated 30,000 kva. self-cooled, 40,000 kva. forced air-cooled. The 161 kv. windings are shielded against surge voltages, the neutrals are insulated for 46 kv. and grounded through 100 ohm. reactors.

Apalachia

The second plant is a tributary medium head type. Apalachia Dam is located on the Hiwassee River and is connected to the power-house 12 miles downstream by a tunnel. The dam having a storage capacity of only 61,250 acre-ft., is primarily a power project. The dam is of the straight concrete gravity structure, 150 ft. high and 1,250 ft. long, with an overflow spillway in the river channel which has a capacity of 150,000 high cfs. and is controlled by 10 32-ft. wide by 23 ft. radial gates. The intake tunnel is, excepting for 6,000 ft. of solid rock, lined for a distance of eight miles with concrete. A 66 ft. differential surge tank, also concrete lined, with a 16-ft. internal riser is at the end of the tunnel. The power-house contains two vertical shaft turbines of the Francis type, each rated 53,000 hp. at 360 ft. head and 225 rpm. The maximum head for this plant is 442 ft., best efficiency is specified for heads between 375 and 440 ft. Each generator is rated 37,500 kw. and since the flywheel effect is 13,200,000 lb. ft. sq. the speed rise is limited to not over 30 per cent above normal with full load rejection and gate closure in 3.6 seconds. Each generator is connected to a 154 kv. bus through a three phase transformer. The ratings of these transformers is 35,000 kva. self cooled, 48,000 forced air-cooled.

Library Notes

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

BOOK REVIEWS

ENGINEERING DRAFTING PROBLEMS

By Kenneth E. Quier. Harper & Brothers Publishers, New York. 16 pp., 80 plates, printed on ledger paper and punched for a standard notebook. Price $2.50.

The problems are carefully selected to cover both the elements of engineering drafting and professional problems in mechanical, civil, chemical, and electrical engineering. The entire course content of the ASTP course in engineering drawing (AST-001, 406) is incorporated, including jigs and fixtures, punch and die work, cams and gears, springs, and lofting principles applied to airplane fuselage and ship contour lines. The problems are organized topically, and hence the workbook can be used with any standard text in engineering drawing. For brief and concentrated courses it can be effectively used without an accompanying text. The order of development is progressive and logical. Engineering Drafting Problems is a thoroughly professional text, designed to prepare the student directly for drafting positions in industry. Emphasis is placed upon increasing his ability to visualize objects in three dimensions. The author is a practising engineer, who does consulting work in addition to his teaching.

REINFORCED CONCRETE WATER TOWERS, BUNKERS, SILOS, AND GANTRIES

By W. S. Gray. Second (revised) Edition. 226 pp. 183 illus. London Concrete Publications, Ltd. Price 10s.; by post 10s. 7d.

Post-war schemes for a more general supply of water, particularly in rural districts, will call for many more water towers of varying heights and capacities. New developments in power stations, gasworks, collieries, and the heavy industries will result in the erection of bunkers, silos, and other storage structures together with suitable handling plant.

To engineers called upon to design these structures this convenient book will be of considerable use. The first part deals with elevated tanks of various shapes —circular, rectangular, conical, and the less common (in Great Britain) Intze tank. Methods of calculation of sections and reinforcement are given with examples taken from actual practice. The storage of hot liquids gives rise to many problems for the designer, and the treatment of this subject should be of assistance.

The second part deals with bunkers and some of the ground bins and pits met with in schemes for the storage and handling of various industrial materials, from the heaviest ores to the lightest coke. The author's treatment is practical rather than theoretical, and is illustrated by many actual examples.

After dealing with the calculations (and giving new tables) for the design of silos by Janssen's and Airy's formulae and the wind stresses in the legs of towers with and without braces, the author includes a section on the actual construction of the types of structure dealt with earlier in the book. This contains many practical hints which the young engineer should lay to heart.

The last section, on gantries, deals with a type of structure which is coming into more frequent use.

STATICALLY INDETERMINATE STRUCTURES

By R. Gartner. London Concrete Publications, Ltd. Price 5s.

The author begins this book of 96 pp. by explaining what are statically indeterminate structures and how they may be made determinate by imaginary cuts or hinges inserted in the members. Equations are then derived connecting the deflections of the primary case with those in which the structure is acted on by n unknowns assumed as unity. The relation between the virtual work done by the external forces and the work done by the internal forces is then found. These are used in one example to find the moments at the supports of a continuous beam of four spans. A valuable comparison is made between taking the moments and the supporting forces as the unknowns. Another example deals with two-hinged frames, and this is followed by the determination of the most economical shape of frame to carry certain loads. The next section deals with continuous beams and fixed points, and this is followed by examples of structures in which there is only one unknown in each equation of deflections.

A considerable portion of the book is devoted to building frames; there is one section on frames with pitched roofs and column footings fixed. Another treats in great detail multi-story single span frames and three-span single-story frames under wind load. An interesting section dealing with the amount of possible error due to the choice of the unknowns brings this useful book to an end.

ADDITIONS TO THE LIBRARY

BOOKS—TECHNICAL AND NON-TECHNICAL

Canadian Almanac and Legal Court Directory, 1945:
Horace C. Corner, ed.; Toronto, Copp Clark, 1945. 9¼ x 6¼ in.

Care and Use of Hand Tools:
Raymond R. Toliver; William C. Lewis, ed.; L. O. Angell, illus. N.Y., John Wiley and Sons, Inc., 1944. 8½ x 5¾ in.

Modern Gas Turbine:
R. Tom Sawyer. N.Y., Prentice-Hall, Inc., 1945. 9¼ x 6¼ in.

Scientific Papers and Addresses of the Hon. Sir Charles A. Parsons:
Hon. G. L. Parsons, ed.; Memoir by Lord Raleigh. Camb., Univ. Pr., 1934. 10¾ x 7½ in.

World Almanac and Book of Facts, 1945:
E. Eastman Irvine, ed. N.Y., New York World-Telegram, 1945. 8¼ x 5¼ in.

PROCEEDINGS, TRANSACTIONS, ETC.

Junior Institution of Engineers:
Journal and Record of Transactions, Volume 54, Sixty-third session, 1943-44.

Institute of the Aeronautical Sciences:
Membership Roster, 1944.

REPORTS, TECHNICAL BULLETINS, ETC.

Canada—Department of Mines and Resources:—Dominion Water and Power Bureau:
Water Resources Paper No. 87:—Surface water supply of Canada, Atlantic drainage . . . Climatic years 1938-39 and 1939-40.
Water Resources Paper No. 90:—Surface water supply of Canada, Pacific drainage . . . Climatic years 1938-39 and 1939-40.

Canada—Department of Mines and Resources—Bureau of Mines:
Report of the Explosives Division, 1939-1943.
Gold Mines in Canada, January 1945.

Canada—Department of Public Works:
Report, 1944.

Canadian Standards Association:

C2-1944: Standard Specification for Single-Phase Distribution Transformers.

Cornell University. Engineering Experimental Station:

Bulletin No. 33:—Radiant Heating and Cooling, Part 2, by C. O. Mackey. 1944.

Electrochemical Society:

Preprints:—86-27: Induction, heating in radio electron tube manufacture.—87-1: Cathodic corrosion of cable sheaths.—87-2: Further studies of functions of chloride in copper-refining electrolyte: Bismuth.—87-3: Extraction of pure cobalt by electrolysis.

Forest Research Institute, Dehra Dun:

Indian Forest Leaflet No. 67: Some ground-nut protein glue formulae and their application.—No. 68: Note on sap stain and its prevention.

Harvard University. Graduate School of Engineering:

Publication No. 397: Numerical solution of partial differential equations by Howard W. Emmons. Reprinted from Quarterly of Applied Mathematics, Oct. 1944.—No. 398: Integral theorems in three-dimensional potential flow by Richard Von Mises. Reprinted from Bulletin of the American Mathematical Society, Sept. 1944.—No. 399: Studies in water disinfection:—1. Destruction of micro-organisms by Shih Lu Chang. Reprinted from Journal of the American Water Works Association, Nov. 1944:—2. Water-Disinfecting tablets by G. M. Fair and others. Reprinted from the Journal of the New England Water Works Association, Sept. 1944.

Ontario. Department of Mines:

52nd annual report, 1943.

Quebec (Prov.) Department of Mines.

Annotated list of publications of the department, 1883-1944. (French and English).

MONOGRAPHS, PAMPHLETS, ETC.

Aircraft industry prepares for the future:

Wash., Aeronautical Chamber of Commerce of America 1944.

Building safety into our highways:

Sidney J. Williams. Chic., American Road Builders Association, 1945.

Canadian Enterprise in Manufacturing:

Toronto, Canadian Manufacturers' Association, 1945. (Reprinted from Industrial Canada, January, 1945.)

Electric Power Distribution for Industrial Plants:

N. Y. American Institute of Electrical Engineers, n.d.

Heat Transfer Equipment:

P. W. Blaylock. (Reprinted from American Institute of Chemical Engineers. Transactions, Volume 40, No. 5, Oct. 1944.)

Les Ingénieurs de Polytechnique et le Progrès du Québec:

Montréal, L'Association des Diplômés de Polytechnique, 1945.

Magafaunal zones of the oligocene of Northwestern Washington:

J. Wyatt Durham. Berkeley, Univ. of California Pr., 1944.

Saskatchewan Plans for Progress:

Regina, King's Printer, 1945.

Statistics Relating to the War Effort of the United Kingdom

Lond., H.M.S.O., 1944.

Story of the Gun:

A. W. Wilson, Woolwich, Royal Artillery Institution, 1944.

Technical and Commercial Developments in Light Gauge Structural Steel:

Milton Male. N.Y., American Institute of Steel Construction 1944.

BOOK NOTES

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.

AERODYNAMICS

By L. R. Parkinson. Macmillan Co., New York, 1944. 112 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $2.25.

This introductory work presents briefly both elementary and advanced phases of the science of flight. Beginning with the theoretical consideration of atmospheric properties and airflow over surfaces, the author continues with practical discussion of lift and drag, stability and airplane performance. The final chapter explains the construction and use of wind tunnels.

ALIGNMENT CHARTS, Construction and Use

By M. Kraitchik. D. Van Nostrand Co., New York, 1944. 94 pp., charts, tables, 9¼ x 6 in., cloth, $2.50.

The opening section of this book provides a review of the algebra, analytic geometry, and determinants necessary for an understanding of the methods of chart construction. The representation of various equations is then discussed and illustrated by means of exercises. Applications are made to the fields of chemistry, engineering, manufacturing and investments. Some of the charts given are ready for use.

CLOUDS, WEATHER and FLIGHT

By T. C. Gillmer and H. E. Nietsch. D. Van Nostrand Co., New York, 1944. 161 pp., illus., diagrs., charts, maps, tables, 11¼ x 8½ in., cloth, $3.75.

The contents of this book represent a development of the basic physical laws of the atmosphere into the principles of air mass analysis and forecasting. Part I covers this material generally for the layman. Part II considers the application of the study of meteorological conditions to aviation, with a special chapter on weather hazards. Part III discusses gliding and soaring flight. The book is copiously illustrated and has a glossary of meteorological terms.

COMBUSTION ON WHEELS, an Informal History of the Automobile Age

By D. L. Cohn. Houghton Mifflin Company, Boston, 1944. 272 pp., illus., tables, 8 x 5 in., cloth, $2.75.

The subtitle, "An Informal History of the Automobile Age", is an apt one. In narrative form the author describes the rise of the automobile from an infrequent curiosity to its present position as the product of a tremendous industry. Its impact, both beneficial and otherwise, on all aspects of American life is fully discussed with serious intent, although the general touch is light. Many humorous anecdotes and two groups of photographs provide further interest.

ÉCOLE POLYTECHNIQUE FÉDÉRALE, Publications du Laboratoire de Photo-Elasticité, No. 1. Etude expérimentale et theorique de la repartition des tensions dans les poutres encastrées.

By M. Robert. S. A. Leemann Frères & Cie., Stockerstrasse 64, Zurich, 1943. 144 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, 9 Sw. frs., 5.80 rm.

The distribution of internal stresses in a fixed beam is described in detail as determined from three transparent models. The theoretical calculations are verified by experiment with photo-elastic methods and cover a varying set of conditions. Numerous tables and plates and a bibliography are appended.

ECONOMICS AS APPLIED TO PRODUCTION AND FACTORY ORGANIZATION

By A. H. Huckle. Mitre Press, Mitre St., London, E.C.3, 1944. 139 pp., charts, diagrs., tables, 8¾ x 5½ in., cloth, 15s.

This book presents a general review of the method of achieving economic co-ordination of the departmental activities throughout a manufacturing organization. Planning procedures are given for estimating machine and labour requirements, for establishing factory layouts and production routing, and for tool and gauge control. Sales budgeting, purchasing, costing and other financial problems are also considered.

ESTIMATING BUILDING COSTS

By C. F. Dingman. 3 ed. McGraw-Hill Book Co., New York and London, 1944. 401 pp., illus., diagrs., tables, 7 x 4 in., fabrikoid, $3.00.

This practical handbook analyzes construction projects into component operations and establishes the cost price to assign to each. The present edition, after a lapse of thirteen years, has been considerably revised, particularly in the methods of earth handling and moving and of concrete handling and finishing. Entirely new chapters on plumbing and heating have been added.

FATS AND OILS, an Outline of Their Chemistry and Technology

By H. G. Kirschenbauer. Reinhold Publishing Corp., New York, 1944. 154 pp., illus., diagrs., tables, 9¼ x 6 in., cloth, $2.75.

A brief, simple survey is presented of the origin, methods of extraction, chemistry and processing of fats and oils derived from plants and animals. Nearly half the book is devoted to the technology of production and refining and to the uses of fats and fatty derivatives in various industries. It is especially designed

(Continued on page 211)

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

March 5, 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 April 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 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—DAVID ADDIE, of 87 Bellwood Ave., Ottawa, Ont. Born at Stratford, Ont., Dec. 5th, 1893. Educ.: I.C.S. course; 1911-12, shift operator in power house, Ontario Hydro Elec. Power Commn., Kitchener & Niagara Falls; 1913-20, i/c power house, 2,000 h.p. hydro elec. for Assoc. Gold fields, also i/c erection of first head frame & installn. of mining machy.; 1921-24, constrn. supt., erection & installn. of 15,000 h.p. elec. steam turbines & boilers, Tampico Light, Heat & Power; 1925-26, travelling elect. supervisor for mtce. of several plants, Eagle Oil Co., Tampico, Mexico; 1926, carried out survey of electl. stations of Guanhatto Power Co., covering 3 states in Mexico, etc.; 1927-33, asst. erecting engr., Cdn. Genl. Elec. Co., supervisn. of final adjustments on wind tunnel, installn. for National Research Council, etc.; 1933 to date, works engr., Electric Reduction Co. of Canada, Ltd., Ottawa, Ont.

References: D. Anderson, G. N. Thomas, C. A. Price, R. M. Prendergast, J. K. Davidson, O. R. Woermke, M. V. Sauer, W. E. Ross.

ANGELL—STANLEY WILLIAM, of 4944 Coolbrook Ave., Montreal, Que. Born at Cardiff, South Wales, July 17th, 1895. Educ.: Dip. Mach. Design, N.S. Tech. Coll., 1923 (short course); 1911-14, genl. mach. shop practice, Pope Tin Mill, Steubenville, Ohio; 1915-19, mach. gun corps, British Army, demobilized as a Lieut.; 1919-31, marine engr., ocean & coastwise services, vessels up to 200 h.p.; 1931-44, service engr., combustion service with industrial & marine plants, engrg. problems in connection with coal docks, etc., & at present, eastern sales manager, Rochester & Pittsburgh Coal Co. (Canada) Ltd., Montreal.

References: W. G. Scott, Ian Maclaren, J. G. Hall, M. Thompson, J. W. Gathercole.

BARCHARD—PHILIP WILSON, of Calgary, Alta. Born at Trail, B.C., Feb. 3rd, 1917. Educ.: B.A.Sc. (Chem.), Univ. of B.C., 1940. 1935-38, breaker boy, constrn. labourer, carpenter's helper, research asst., & 1939-40, asst. to res. engr., Public Works Dept.; 1940-41, constrn. of nitric acid, ammonium nitrate & ammonia plants at Warfield, B.C., Consldt. Mining & Smelting Co., Trail, B.C.; 1941 to date, asst. chemical supervisor, Alberta Nitrogen Products, Ltd., Calgary, Alta.

References: J. P. Svarich, J. V. Rogers, A. C. Ridgers, S. C. Montgomery, J. Haddin.

BROCK—THOMAS LEITH, of Kingston, Ont. Born at Kingston, Ont., Aug. 12th, 1912. Educ.: Grad., R.M.C., B.A.Sc., Univ. of B.C., 1937, M.A.Sc., Mass. Inst. Tech., 1938; With the Aluminum Co. of Canada, Arvida, as follows: 1938-39, junior engr., ore plant, testing, experimental, etc., 1939-40, asst. engr., part time supervn., & 1940-42, asst. supt., fluoride plant i/c operations, later included fluorspar flotation plant & sulphuric acid plant; 1942-45, supt., fluoride divn., & at present, i/c publications dept., Aluminium Laboratories, Ltd., Kingston, Ont.

References: McN. Dubose, A. W. Whitaker, A. C. Johnston, M. G. Saunders, C. Camsell, M. P. Weigel, F. T. Boutilier.

BRUSSET—JOHN ALBERT, of Blairmore, Alta., Born at St. Just, France, Jan. 9th, 1898; Educ: Mining Engr., National School of Mines, St. Etienne, France, 1921; Member, C.I.M.M; 1922-27, mine mgr., Compagnie des Mines de Lens, France; 1927-30, mgr., iron and copper mines, Phillippeville, Algeria, Africa; 1930-45, asst. gen. mgr., gen. mgr., and at present, vice-president and managing director, Western Canadian Collieries, Blairmore, Alta.

References: F. V. Seibert, E. P. Fetherstonhaugh, J. E. Armstrong, L. A. Wright, deGaspé Beaubien.

CALLAGHAN—JOHN CLINTON, of Hamilton, Ont. Born at Montreal, Dec. 24th, 1884. Educ.: B.Sc. (Mech.), McGill Univ., 1908; 1908 to date, with Canada Screw Co., then with the Steel Co. of Canada, of which the Canada Screw Co. became Canada Works, & since 1923, works manager, Canada Works, Steel Co. of Canada Ltd., Hamilton, Ont.

References: H. G. Bertram, W. D. Black, C. J. Porter, H. A. Cooch, A. R. Hannaford, N. A. Eager, H. J. A. Chambers, W. E. Brown.

CARPENTER—DONALD DAVID, Major, of 526 Laurier Ave., West, Ottawa, Ont. Born at Stirling City, Cal., Jan. 3rd, 1906. Educ.: 1923-24, Univ. of Cal., Member, R.A.I.C. With the B.C. Elec. Co. as follows: 1925-26, instru'mn., 1926-27, field engr., 1927-29, architecl. dftsman., 1929-31, asst. architect., 1931-33, field architect; 1933-36, constrn., numerous bldgs., bridges, etc., Vancouver, private practice; 1936-38, Lion's Gate Bridge, design & constrn. of plant, later, supervisn. of constrn., Stuart Cameron & Co.; 1938-39, design of roadways, concrete bridges, etc., British Pacific properties; 1939-40, Lieut. i/c design & constrn., fortress communications, Pacific Command; 1940-43, Capt., T.S.O. 111, development engr., Directorate of Tech. Research (Signals), Ottawa; 1943-45, Major, T.S.O. II, tech. asst. to the Director, Directorate of Electrical & Communications Design, Dept. of National Defence, Ottawa.

References: E. A. Cleveland, J. P. Mackenzie, N. D. Lambert, R. E. Jamieson.

COWAN—WILLIAM KENNEDY, of Town of Mount Royal, Que. Born at Napanee, Ont., Aug. 24th, 1914. Educ.: B.A.Sc., Univ. of Toronto, 1939; With the Aluminum Co. of Canada as follows: 1939 (summer), ap'tice. course, 1939-40, engrg. design, Arvida; 1940-41, asst. supt. of constrn. & 1941-44, supt., mines mech. dept., Demerara Bauxite Co. Ltd., Mackenzie, British Guiana; At present, sales engr., Aluminum Co. of Canada, Ltd., Montreal, Que.

References: F. L. Lawton, M.P. Weigel, A. W. Whitaker, Jr.

CRANE—GEORGE JOSEPH, of Buckingham, Que. Born at London, England, April 29, 1917. Educ.: B.A.Sc. (Elec.), Univ. of B.C., 1941; 1938, McBain Marine Equipment Co.; 1939-40, genl. mining, Britannia Mining & Smelting Co.; 1931-42, testman, Cdn. Genl. Elec. Co., Peterborough & Toronto; With the Elec. Reduction Co. Ltd., Buckingham, as follows: 1942-43, elect. supt., responsible for electl. planning & installn., 1943-44, i/c mtce. & engrg., & 1944 to date, development engr., i/c engrg. development & design of new plants, etc.

References: J. K. Davidson, D. Anderson, G. R. Langley, C. E. Sisson, B. I. Burgess, O. W. Titus, J. MacLeod, J. N. Finlayson.

DIAMOND—RANDOLPHE WILLIAM, of Trail, B.C. Born at Campbellford, Ont., Feb. 26th, 1891. Educ.: B.A.Sc., Univ. of Toronto, 1913; Member, Inst. of M. & M. (London), Amer. Inst. of M. & M. Engrs. & The Cdn. Inst. of M. & M.; 1913-17, testing, research & concentration depts., Anaconda Copper Mining Co.; 1917, mill supt., Ohio Copper Co. of Utah; With the Consldt. Mining & Smelting Co. of Canada, Ltd., as follows: 1917-29, supt. of concentration, 1929-36, genl. supt., concentration, chem. & fertilizer depts. 1936-39, asst. genl. supt., Trail operations; 1939-44, asst. genl. mgr., 1945 to date, genl. mgr.

References: deG. Beaubien, L. A. Wright, S. C. Montgomery, S. G. Blaylock

DINGMAN—CHARLES WILLARD, of 514 Sunderland Ave., Calgary, Alta. Born at Toronto, Ont., July 4th, 1888; R.P.E., Alta.; 1913-20, Calgary Petroleum Products; 1920-30, with Office Federal Govt. as supervn. engr. & later petroleum engr.; 1930-33, i/c Calgary office, petroleum & natural gas divn., Dept. of Lands & Mines (Prov. of Alta.); 1933-35, private practice; 1935-38, director, petroleum & natural gas divn., Dept. of Lands & Mines (Prov. of Alta.); 1938-41, member & deputy chairman, Petroleum & Natural Gas Conservation Board, Calgary; 1941 to date, chief petroleum engr., Home Oil Co. Ltd., Calgary, Alta.

References: R. MacKay, F. K. Beach, J. McMillan, J. B. deHart, H. J. McEwen.

DROLET—JEAN PAUL, of 13 Canardiere Road, Quebec, Que. Born at Quebec, Que., July 15th, 1918. Educ.: B.A.Sc., Laval Univ., 1942; R.P.E., Que.; 1939 (summer), Noranda Gold Mines, Ltd.; 1940 (summer), Beattie Gold Mines, Ltd.; With the Dept. of Roads (Quebec as follows: 1941 (summer) & 1942-43, soil engr.; 1943 to date, mining engr., Dept. of Mines, Quebec, Que.

References: R. Dupuis, J. O. Martineau, G. W. Waddington, G. St. Jacques.

GRAY-DONALD—NIGEL, of Asbestos, Que. Born at Preston, England, June 16th, 1891. Educ.: 1935-39, British Inst. of Engrg. Tech., London (Corres. course); A. M., Inst. Mech. Engrs.; 1924-25, travelling engr., Crowther Fuel Economizer Ltd., London, running steam trials in many plants in Great Britain & Northern Ireland; 1925-26, dftsman., International Harvester Co., Hamilton; 1926-27, combustion engr., St. Lawrence Paper Co., Three Rivers; 1929 to date, senior dftsman., designer and at present, mech. engr., i/c mach. design, specifications for mtce. materials, field supervisn., etc., Canadian Johns-Manville Co. Ltd., Asbestos, Que.

References: H. R. Lynn, N. M. Campbell, H. T. Doran, J. R. Carter, H. B. Horne.

GREENLAW—JAMES WILSON, of Winnipeg, Man. Born at Minnedosa, Man., Oct. 26th, 1906. Educ.: B.Sc. (Elec.), Univ. of Man., 1929; 1928 (summer), constrn.; With the Cdn. Genl. Elec. Co. as follows: 1929-30, elec. test course, 1930-31, elec. motor design & plant design, 1931-32, lighting design, & 1932-40, lighting engr.; 1940 to date, consltg. electl. engr., Lighting Materials Co., Winnipeg, Man.

References: N. M. Hall, H. L. Briggs, C. P. Haltalin, T. E. Storey, E. P. Fetherstonhaugh.

KELLETT—JAMES EDWARD, of 407 Lipton St., Winnipeg, Man. Born at Vankleek Hill, Ont., Dec. 15th, 1903. Educ.: B.Sc. (Civil), Univ. of Man., 1926; 1923-25 (summers), chainman & rodman on various surveys; 1925-26, instru'mn., McColl Bros., surveyors & engrs.; 1926-27, instru'mn., paper mill constrn. & townsite layout, Manitoba Paper Co., Pine Falls, Man.; 1927 (summer), inspr., reinforced concrete bridge constrn., 1927-28, transitman & chief of party on highway location, & 1928-31, res. engr., highway design & constrn., Man. Good Roads Board; 1938-40, asst., gold dredging, Yukon Consldt. Gold Corpn.; 1941 (4 mos.), asst. engr. & 1941-42, Works Officer i/c airport constrn. & mtce., No. 2 T.C., R.C.A.F., Dafoe, Sask.; 1942-43, Staff Officer, aerodrome mtce., & 1943-44, supervn. of constrn. & mtce. of blds., etc., Winnipeg; At present, senior asst. engr., chief engineer's branch, Dept. of Public Works, Winnipeg (Temporary).

References: A. J. Taunton, W. E. Hobbs, E. P. Fetherstonhaugh, G. H. Herriot, P. E. Doncaster.

KEPPY—JOHN C., of London, Ont. Born at Toronto, Ont., March 16th, 1908. A.M., A.I.E.E.; R.P.E., Ont.; 1925-26, tracer, dfting. dept., Kerry & Chace, Ltd., Toronto; With the Bell Telephone Co. as follows: 1927, pole inspr., 1928-37, junior engr., on exchange transmission work, 1938-39, asst. engr. on physical co-ordination, negotiating joint use agreement with hydro. commns. throughout Ont., 1940, asst. engr., outside plant work, 1941, staff asst. to divn. plant engr., 1942, acting divn. toll engr., Toronto, 1943, staff asst. to divn. plant engr., 1944 to date, district plant engr., London & Windsor Districts.

References: W. G. Lloyd, D. G. Geiger, H. G. Rose, E. K. Mueller, W. H. Slinn.

KILBURN—KENNETH McRAE, of Ottawa, Ont. Born at North Bay, Ont., Sept. 12th, 1914. Educ.: 1935-38, Queen's Univ., civil engrg.; I.C.S. course; 1936 (summer), rodman, 1937 (summer), concrete inspr., 1938 (summer), instru'mn., & asst. to location engr.; 1939-40, dftsman. & officer engr., highway constrn., Ontario Dept. of Highways; With the Dept. of National Defence as follows: 1940-41, instru'mn., constrn. of air port at Aylmer, 1941-42, junior engr., airport constrn. at Centralia, etc.; 1942 (3 mos.), asst. engr., transferred to Western Air Command, design & layout, sewers, bldgs., etc.; 1942-43, junior engr. & asst. to supervising engrs. on various sections of the Terrace-Cedarvale Highway Project, Dept. of Mines & Resources; 1944 to date, sapper, R.C.E., Ottawa, Ont.

References: J. M. Wardle, T. S. Mills, J. N. Stinson, D. G. Kilburn.

LEESE—JAMES HAROLD, Capt., R.C.E., of 314 Berry St., St. James, Man. Born at Stoke-on-Trent, England, April 4th, 1895; 1909-11, architect's asst., Stoke-on-Trent; 1917-44, with Dept. of National Defence, as engr. clerk, dftsman., works foreman, field supt. & engr., i/c constrn., air bases, relief camps, military hospital, etc., & mtce., & at present, Works Officer, Military District No. 10, Engr. i/c Works & Bldgs., Brandon, Shilo Camp & Portage La Prairie, Man. (Asks for admission as an Affiliate).

References: H. J. A. Bird, W. W. Ramsay, G. N. Range, J. N. McLean, W. F. Riddell, E. C. Cowan.

LOCKHART—DANIEL C., of Moncton, N.B. Born at Lewisville, N.B., April 28th, 1891. Educ.: Home study & special course in mechanics & locomotive design (3 yrs. evening study under direction of F. Williams, M.E.I.C.); With the C.N.R. as follows: 1910-14, machinist ap'tice., Moncton; 1914-29, dftsman., mech. engrg. dept., 1929-44, chief dftsman., responsible for all drawings, bills of material, estimates, etc., issued from the office of the mech. engr., & 1944 to date, mech. engr., Atlantic Region, Moncton, N.B.

References: F. Williams, J. Pullar, J. A. Godfrey, E. B. Martin, V. C. Blackett.

LYALL—JAMES RUSSELL, of Vancouver, B.C. Born at Durham, England, Jan. 1899. Educ.: Corres. course, structl. engrg., Univ. of Wisconsin; R.P.E., B.C.; 1914-22, with the Lumsden Machine Co., Gateshead-on-Tyne, experience in drawing office, mach. & pattern shop; 1924-28, dftsman., engaged in plant layout, field inspr., etc., & 1928-38, structl. engr., i/c design of grain elevator & affiliated structures, John S. Metcalf Co. Ltd., Vancouver; 1938-44, designing dftsman., & at present, senior designing dftsman., City of Vancouver, B.C.

References: E. F. Carter, A. Pearson, C. Brakenridge, J. B. Barclay, P. B. Stroyan, R. C. Pybus.

MEYERS—CARL BEVERLEY, of Red Rock, Ont. Born at Quebec, Que., April 11th, 1914. Educ.: 1937-40, Three Rivers Tech. School (evening classes in mech. drawing); At present, studying engrg. with I.C.S.; 1939-41, junior dftsman., Consldt. Paper Corpn., Three Rivers, Que.; 1941-42, dftsman., J. C. Day, constrn. of mills at Beauharnois, Windsor Mills & Merritton, Ont.; 1942-44, dftsman. & designer, Aluminum Co. of Canada, Montreal; 1944 to date, dftsman., paper mill layout & equipm't., Brompton Pulp & Paper Co. Ltd., Red Rock, Ont.

References: J. A. Dickinson, D. G. Elliot, C. A. Hellstrom, W. B. Korcheski A. L. Martin.

NAPIER—CHARLES EDWARD, of Toronto, Ont. Born at Montreal, Que., Nov. 16th, 1902; Educ.: B.Sc. (Mech.), McGill Univ., 1925; 1929-40, Canadian representative for Anthracite Institute covering Ontario & Quebec; With R.C.A.F. Headquarters, Ottawa, as Officer i/c design & constrn. of water systems, fire protection, storm water drainage, etc., for R.C.A.F. sites in Canada, Nfld. & Labrador, retired to reserve from position of Deputy Director of Engrg. Services; At present, sales engr., specializing in water pumping equipment, etc., Consolidated Engines & Machinery Co. Ltd., Toronto, Ont.

References: J. B. Stirling, G. L. Wiggs, H. R. Montgomery, R. R. Collard

PENNEY—JOHN MORTIMER, of Vermilion, Alberta. Born at Croydon, England, Sept. 14th, 1901; Educ.: 1917-20, Croydon Polytechnic & Stanley Tech. School, Norwood, England (night school); 1916-20, ap'tice., A. Leonard & Co., tool & gaugemakers, Croydon, England; 1920-22, asst. field engr. & 1922-24, tooldresser & driller, Colombian Oilfields, Ltd.; 1924-25, tooldresser & 1925-26, asst. to mgr., Coastal Oilfields of Colombia; 1927-28, driller, & 1928-30, supt. driller, P.W.Dept., Georgetown, B.W.I.; 1930-32, field supt., & 1932-33, prodn. supt., Trinidad Petroleum Development Co.; 1933-34, drilling supt., & 1934-42, field mgr., Ecuador Oilfields, S.A.; 1942 to date, mgr., Cannar Oils Ltd., Vermilion, Alta. (Asks for admission as an Affiliate.)

References: B. E. Bury, F. V. Seibert, H. A. Dixon.

SIMARD—LAURENT, of 853-5th St., Arvida, Que. Born at Roberval, Que., Sept. 18th, 1917. Educ.: B.A.Sc., Laval Univ., 1943; 1943-45, with the Aluminum Co. of Canada and, at present, asst. supervisor, fluoride plant, Arvida, Que.

Reference: G. W. Waddington, D. D. Reeve, M. G. Saunders, R. Dupuis.

STRATTAN—DUDLEY HAROLD, of 174 Yale Ave., Winnipeg, Man. Born at Melita, Man., Sept. 12th, 1910. Educ.: B.Sc. (Civil), Univ. of Man., 1935; 1935 (7 mos.), constrn. engr.; 1936-38, contractor, road constrn., 1938-40, field engr., Dominion Bridge Co.; 1940-43, engr., Sherritt Gordon Mines; 1943-44, Lieut., R.C.E.; 1944-45, contractor & genl. mgr., Stratton Engineering Co. Ltd., Winnipeg, Man.

References: W. J. D. Cameron, C. A. Proudfoot, D. M. Stephens, N. McL. Hall, G. H. Herriot.

THOMPSON—SAMUEL LANKTREE, Capt., R.C.E. Born at Belfast, Ireland, Feb. 1902. 1918-20, dftsman., & 1920-23, sales engr., Pease Western Foundry, Winnipeg; 1923-27, in business for self, res. constrn. work; 1927-40, president, Lanktree Thomson Bldg. Co., designers & builders; 1940, Lieut., R.C.E., 2nd i/c No. 4 Coy., Dundurn Military Camp, Sask., 1942, Officer i/c new constrn. for M.D. No. 10, later, Capt., with Director of Works & Constrn., N.D.H.Q., Ottawa, 1944, Liaison Officer for Army Engr. Service, M.D. 10 & M.D. 12, 1944 to date, Asst. to D.E.O., M.D. 10, Fort Osborne Barracks, Winnipeg, Man. (Asks for admission as an Affiliate.)

References: W. W. Ramsay, J. N. McLean, H. J. A. Bird, W. F. Riddell.

WALSH—GEOFFREY, Brigadier of Canadian Army Overseas. Born at Brantford, Ont., Aug. 19th, 1909. Educ.: B. Eng., McGill Univ., 1933; 1928, chainman, survey party, Welland Canal; 1929, instru'mn., Ont. Land Surveying; 1939-40, D.E.O., M.D. 2, Toronto, directed planning & constrn. of temporary barracks, etc., initial development of Camp Borden, all phases of constrn., etc., 1940, O.C., engrg. coy., carrying out constrn. of defences, & subsequently commanded divn. of engrs. in Sicily, 1944, became Chief Engr. of a corps, & in Sept., 1944, Chief Engr., 1st Cdn. Army, all work involved in these positions being of a confidential nature but all related to engrg. work of the army.

References: C. V. Christie, H. G. Thompson, G. W. Beecroft, H. Kennedy, J. L. Melville, G. R. Turner.

WILLIAMS—CHARLES REGINALD, of 91 Dewbourne Ave., Toronto, Ont. Born at Toronto, Ont., Sept. 5th, 1898. Educ.: 1914-19, Central Tech. School, Toronto, evening classes; extension courses at Univ. of Wisconsin & Columbia Univ.; evening classes in maths., Toronto University, R.P.E. Ont.; 1914, student with John M. Lyle, architect, Toronto; 1915 (summer), junior dftsman., Wm. Cowlin & Son, Toronto; 1915-18, dftsman. & junior engr., hospitals & institutions branch, Ontario Govt.; With Jackson Lewis Co. Ltd., Toronto, as follows: 1918-21, asst. engr., 1921-22, engr., estimating, designing, etc., 1922-23, res. engr., i/c constrn. dairy bldg. & power plant, Farmers Dairy Co., 1923-26, engr. i/c estimating & asst. to pres. in supervn. of contracts; 1926-34, vice-pres. & engr.; 1934-35, res. engr., constrn. of addition to Toronto Western Hospital; 1935-37, engr., constrn. & mtce. dept., Ont. Region, Sun Oil Co. of Canada; 1937-40, engr., Dickie Constrn. Co. Ltd., Toronto; 1940-42, engr. in administrative charge, A. W. Robertson, contracting engrs., Toronto, Ont.; 1942 to date, vice pres. & engr., Dickie Constrn. Co. Ltd., Toronto, Ont

References: W. R. McCaffrey, N. L. Crosby, F. P. Flett, F. R. Phillips, G P. Wilbur, Norman A. Eager, W. C. Smith, J. M. Oxley.

YOUNG—DUDLEY STEWART, of Toronto, Ont. Born at Souris, Man., May 3rd, 1904. Educ.: B.Sc. (Elec.), Univ. of Man., 1925; S. M., Mass. Inst. of Tech., 1927; 1921, rodman, municipality of Glenwood; 1922, rodman, steel worker & inspr., power development, Fraser Brace Co. Ltd., Great Falls; 1923, rodman, dftsman., bridge inspr., C.P.R. Co., Wymark, Sask.; 1924-26, inspr., dftsman., elec. design, Winnipeg Hydro Elec., Winnipeg; 1926, testing of transformers, oil circuit breakers, etc., Detroit Edison Co., Detroit; 1927-28, rate investigations, etc., Elec. Bond & Share Co., N.Y.; 1928-44, district engr., western district, Anaconda Wire & Cable Co., Chicago, Ill.; 1944 to date, development engr., Canada Wire & Cable Co. Ltd., Toronto, Ont.

References: J. W. Sanger, E. P. Fetherstonhaugh, O. W. Titus, E. V. Caton

ZORZI—JOSEF, of St. Eustache-Sur-Le-Lac, Que. Born at Kippenheim Baden, Germany, Oct. 4th, 1909, Educ.: B.Sc. (Civil), Tri State College, Indiana, 1939; R.P.E. Que. 1943; 1941 (Jan. to June), reinforced concrete detailer, C. B. Dolphin, Architect, Toronto; 1941 to date, designing engr., The Foundation Co. of Canada, Ltd., Montreal, Que.

References: W. Griesbach, H. V. Serson, L. H. Burpee, G. Pradl.

FOR TRANSFER FROM JUNIOR

BELLE-ISLE—JOSEPH GERARD GERALD, of 38 Bridge Street, Hull, Que. Born at Ste. Madeleine, Que., July 7th, 1914. Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1938; With the Roads Dept. (Que.) as follows: 1932-36 (summers), instry'mn. & asst. res. engr., 1937, leader of a surveying party, 1938-40. asst. divn. engr., 1940-41, divn. engr.; 1941-42, plant engr., Bell Telephone Co.; 1942-44, With the R.C.A.F. as Asst. Adj. Transportation Officer, Air Cadets Liaison Officer, etc.; 1944 to date, Officer i/c Technical Publication, Directorate of Intelligence, Airforce Headquarters, Ottawa, Ont. (Junior 1943)

References: D. A. S. Laing, C. E. Frost, L. Ennis, R. St. Pierre, E. Gohier, L. Trudel, A. Gratton.

BROWN—RALPH CUTHBERT CHISHOLM, of 119—9th Ave., Longueuil, Montreal, Que. Born at Ottawa, Ont., Nov. 8th, 1910. Educ.: B.Sc. (Mech.), Queen's Univ., 1933; R.P.E. Que.; 1928-29-30 (summers), asst. to res. engr., Dept. of National Defence, constrn. of Rockcliffe Stations; 1931, toolmakers' asst., Campbell Steel & Iron Works; 1936-37, dftsman., R.C.A.F., Aeronautical Engrg. Branch; 1937-38, junior aero, engr., Fairchild Aircraft Ltd.; 1938-39, junior aero. engr., doing stress analysis, checking & developing departmental aircraft modifications, etc., Dept. National Defence; 1939-40, dftsman., R.C.A.F., Aero. Engrg. Branch; 1940-41, completed course at R.C.A.F. School of Aero. Engrg.; 1940-44, aircraft mtce. & repair supervn. at various R.C.A.F. units; At present, designer, mech. control design group, Canadair, Ltd. (Jr. 1938).

References: E. W. Stedman, A. Ferrier, L. M. Arkley, L. T. Rutledge, A. L. Clark.

CHAPLIN—HERBERT ELLIOTT, of Montreal, Que. Born at St. John's Nfld., Sept. 2nd, 1910. Educ.: B.Eng. (Elec.), McGill Univ., 1934; With the Imperial Tobacco Co. as follows: 1930-34 (summers), mech. stores, dfting., elec. dept., mach. shop, 1934-36, engrg. dept., 1936-38, asst. to factory engr., & 1939, factory engr., Montreal. (Junior 1938).

References: J. T. R. Steeves, N. C. Cameron, W. A. James, R. C. Flitton, C. V. Christie.

ROSS—ARTHUR LeBRETON, of Ajax, Ont. Born at Sault Ste. Marie, Ont., Oct. 7th, 1910. Educ.: B.Eng. (Elec.), McGill Univ., 1932; R.P.E. Ont.; 1930-31 (summers), ap'tice., Southern Canada Power Co., 1932-33, dftsman., 1933-34, electrician, & 1934, asst. to plant engr., Noranda Mines Ltd.; 1934-40, sales engr., also responsible for prodn., purchasing, etc., Railway & Power Engrg. Corpn.; 1940-41, asst. elec. engr., elec. layout & design of several large munition plants, 1941 (8 mos.), asst. project engr., 1941-43, plant engr. & prodn. supt., & 1943 to date, plant engr., Defence Industries Ltd., Pickering Works, Ajax, Ont. (Jr. 1939)

References: D. A. Killam, H. C. Karn, C. H. Jackson, M. S. Macgillivray, R. DeL. French, I. R. Tait, T. M. Moran, J. W. LeB. Ross.

ROSS—DONALD, of Edmonton, Alta. Born at Melville, Sask., Nov. 6th, 1916. Educ.: B.Sc. (Civil), Univ. of Alta., 1940; R.P.E. Alta.; 1936 (summer), chainman & rodman, C.N.R.; 1937-39, inspn. of services, Waterworks Dept., & 1940 (6 mos.), instru'mn., Dept. of Transport, City of Edmonton, Alta.; 1940-42, A.I.D. inspr., 1942-43, senior inspr., supervisor of airframe & aircraft inspn., etc., & at present, supervising inspr., Dept. of National Defence, Edmonton, Alta. (Jr. 1941).

References: I. F. Morrison, W. R. Mount, H. A. Bowden, J. G. Dale, L. A. Thorssen.

SWIFT—LIONEL, of 511 St. Cyrille St., Quebec, Que. Born at Shawinigan Falls, Que., Aug. 8th, 1910. Educ.: B.Eng. (Elec.), McGill Univ., 1934; 1930-31-32-33 (summers), power house constrn., mtce., etc., at Rapide Blanc & Shawinigan Falls, Shawinigan Engrg. Co.; 1934-36, ap'tice. course in various depts., transmission lines, system operating, etc., 1936-39, transferred to Thetford Mines District, mtce. work, all electl. testing, sub-station operation, etc., & 1939-44, asst. district supt., Shawinigan Water & Power Co. At present, elec. engr., i/c. engrg. dept., Quebec Power Co., Quebec, Que. (Jr. 1941).

References: E. D. Gray-Donald, R. Dupuis, A. L. Hough, W. R. Way, E. W. Knapp.

VILLEMURE—PHILEAS J. of Grand'Mere, Que. Born at Ste. Flore, Que., Oct. 12th, 1910. Educ.: I.C.S. civil engrg. course & private tuition; passed Institute's exams for Student in 1931 & for Junior in 1937; 1929 (3 mos.), junior dftsman., forestry dept., Laurentide Co.; 1930, junior dftsman., Shawinigan Chemicals Ltd.; 1931-37, dftsman. & instru'mn., & 1937 to date, design & layout of sewers, water systems, industrial bldgs., etc., and at present, town engr., City of Grand'Mere, Que. (Jr. 1937).

References: E. B. Wardle, P. L. Pratley, R. Dorion, H. G. Timmis, A. Fleischman, V. Jepsen.

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BLANCHARD—JOHN RUST, of Temiskaming, Que. Born at Niagara Falls, Ont., Aug. 29th, 1919. Educ.: B.Eng., McGill Univ., 1941; 1939 (summer), Mersey Paper Co., Liverpool, N.S.; 1940 (summer), Thorp, Hambrock Co., Montreal, Que.; 1941 to date, bleachery chemist, control & operation of bleachery & electrolytic plant, Cdn. International Paper Co., Temiskaming, Que. (St. 1940).

References: J. A. Freeland, H. R. M. Acheson, E. Brown, M. V. Sauer, J. T Farmer, A. C .D. Blanchard.

BUBBIS—NATHAN SIMON, of Winnipeg, Man. Born at Philadelphia Pa., Nov. 2, 1912. Educ.: B.Sc. (Civil), Univ. of Man., 1934; 1934-39, drfsman., 1939-42, designing dftsman., 1942-43, asst. designing engr., 1943-44, asst. engr., i/c design & dfting. room, & 1944 to date, engr. of waterworks & sewerage, mtce. & operation of water distribution, etc., City of Winnipeg, Man. (St. 1934).

References: W. D. Hurst, F. S. Adamson, W. P. Brereton, T. E. Storey C. V. Antenbring, A. E. Macdonald, D. M. Stephens, W. J. D. Cameron.

CUNNINGHAM—ROBERT AULD, of Port Mellon, B.C. Born at Greenock, Scotland, Jan. 24th, 1918. Educ.: B.Sc. (Civil), Queen's Univ., 1941; 1938-39 (summers), miner, McIntyre Porcupine Mines, Ltd.; 1940 (summer), transitman, Dept. of Transport; 1941, junior engr., dfting. & surveying, Price Bros. & Co.; 1942-44, field engr., E. G. M. Cape & Co., Nfld., layout, genl. engrg., etc.; 1944 (5 mos.), transitman, C.P.R., Trenton divn. & later at Toronto; At present, asst. to res. engr., Sorg Pulp Co., Port Mellon, B.C. (St. 1941).

References: D. S. Ellis, A. Cunningham, J. B. Stirling, D. A. Forbes, M. W. Huggins.

DUNCAN—FREDERICK ROBERT, 2nd Lieut., of Kingston, Ont. Born at Fort William, Ont., Feb. 1st, 1918. Educ.: B.Eng. (Elec.), McGill Univ., 1940; Barrister-at-law (Ontario); 1940-41, test course & 1941-44, law dept., Cdn. General Electric Co.; 1944 to date, 2nd Lieut., R. C. Signals, Vimy Barracks, Kingston, Ont. (St. 1939).

References: W. L. Bird, S. T. McCavour, H. G. O'Leary, E. MacGill, G. R. Langley, C. V. Christie, C. M. McKergow.

DUNCAN—GEORGE PATERSON, F/O, R.C.A.F., of Charlottetown, P.E.I. Born at Rosebank, Man., July 26th, 1914. Educ.: B.Sc. (Civil), Univ. of Man., 1938; 1937 (summer), rodman & instru'mn., topographic survey, & 1938-40, instru'mn., P.F.R.A.; 1940-41, junior engr., Dept. of National Defence, 1941 (7 mos.), material engr., & 1941 (5 mos.), safety engr., cordite plant, Fraser Brace Co. Ltd., Winnipeg; For the last 3 yrs. to date, Instructor in Navigation, R.C.A.F., Charlottetown, P.E.I. (St. 1938).

References: B. B. Hogarty, G. H. Herriot, C. H. Attwood, A. J. Taunton, A. E. Macdonald, E. P. Fetherstonhaugh.

GRIMBLE—LOUIS GEORGE, Leading Airman, of Edmonton, Alberta. Born at Edmonton, Alta., July 5th, 1920 Educ.: B.Sc. (Civil), Univ. of Alta., 1942; 1939 (summer), rodman & 1940 (summer), student asst., Govt. Survey; 1941 (summer), instru'mn., airport constrn; 1942-44, junior highway bridge engr., U.S. Public Roads Administration, on the Alaska Highway, & res. engr., constrn. of severa large stee reinforced concrete bridges; At present, pilot under training for the Royal Navy Fleet Air Arm, No. 13 E.F.T.S., St. Eugene, Ont. (St. 1942).

References: R. S. L. Wilson, R. M. Hardy, I. F. Morrison, W. W. Preston, R. W. Ross.

HUGHES—GORDON L., of Smiths Falls, Ont. Born at Primate, Sask., April 16th, 1919. Educ.: B.Sc. (Mech.), Univ. of Sask., 1942; 1941 (summer), instru'mn., topographic & relocation surveying, P.F.R.A.; 1942 (5 mos.), detail method of prodn., timing & cost of new projects, & 1942-45, design, layout & development of improvements for new agricultural machy., also supervn. of all patterns, tools, etc., at present, project engineer, Frost & Wood Co. Ltd., Smiths Falls, Ont. (Student 1941).

References: W. P. Cheney, P. Climo, I. M. Fraser, W. E. Lovell, N. B. Hutcheon, E. K. Phillips.

KANE—REDMOND JOHN, Lieut. (SB) (E), R.C.N.V.R., of Halifax, N.S. Born at Outremont, Que., Feb. 24th, 1918. Educ.: B.Eng. (Civil), McGill Univ., 1941; R.P.E. Que.; 1938-39 (summers), junior engr. on power project, Ottawa River, Quebec Streams Commn.; 1941, asst. to portmaster at Port Alfred, Que., on mtce. of unloading equipm't., towers, etc., Aluminum Co. of Canada; 1943-44, supervn. & inspn. of heavy naval ordnance equipm't during repair & mtce., R.C.N.V.R.; At present taking Engineer Officers' Ordnance Course directed by the Royal Navy. (St. 1940).

References: E. Brown, C. M. McKergow, R. E. Jamieson, G. J. Dodd, A. I. Cunningham, G. O. Vogan.

LEVASSEUR—JOSEPH ADRIAN MAURICE, of 36 Filiatreault St., St. Joseph de Sorel, Que. Born at Montreal, Que., Aug. 14th, 1917. Educ.: 1933-37, Montreal Tech. School; Passed Institute exams. for admission as Junior in Nov. 1944; At present, student, I.C.S. course, Scranton, in elec. engrg.; 1937-38, ap'tice., C.N.R.; 1938-41, inspr., M.L.H. & P.Co., meter & elec. services; 1941 to date, junior engr., elec. engrg. dept., Sorel Industries Ltd., Sorel, Que. (Student 1944).

References: H. Gendron, J. A. Lalonde, P. S. Gregory, L. L. O'Sullivan, F. P. Rousseau.

MacDONALD—ARTHUR LAMOND, Major, R.C.E., of Ottawa, Ont. Born at Glace Bay, N.S., June 23rd, 1914. Educ.: B.Sc., Acadia Univ., 1935; B.Eng.(Elec.), N.S.Tech. Coll., 1938; 1932-33-34 (summers), sectionman, welder's helper, C.B. Tramways, Sydney; 1935, student asst., topgl. branch, Geological Survey; 1936 (summer), pole line work, meter room asst., etc., Eastern Light & Power Co. Ltd., Sydney; 1937 (summer), engr., inspr., contract dredging, P. W. Canada, Halifax; 1938-39, junior engr., line location, trouble dept., etc., Eastern Light & Power Co.; 1939-40, Lieut., Wks. Officer, R.C.E. i/c wks. & constrn. of bldgs., etc., 1940-42, Capt., Officer i/c searchlight installns., Cdn. East Coast & Nfld., 1942-44, Second in Command, Heavy Coast Bty., R.C.A.; At present, Inspr. of Elec. Engrg., Inspection Board of the United Kingdom & Canada, Ottawa, Ont. (St. 1938).

References: F. H. Sexton, C. M. Smyth, H. G. Mosley, M. F. Cossitt, H. S. Dunn, J. R. Morrison.

MacLEOD—GORDON, of Calgary, Alta. Born at Weyburn, Sask., Feb. 28th, 1913. Educ.: B.Eng. (Elec.), McGill Univ., 1935; 1936, Hoosier Engrg. Co., Montreal; 1936-37, Schick Shaver Co., St. John, Que.; With the C.P. Communications as follows: 1938-39, transmission tester, & 1939-43, special studies engrg., specifications for outside plant engr., Montreal, 1943 to date district engr., i/c all communications for Alberta & B.C., Calgary, Alberta. (St. 1936).

References: C. V. Christie, R. W. Dobridge, L. A. W. East, J. E. Sproule, W. E. Cooper.

MORRIS—RONALD WILLIAM, Capt., R.C.E.M.E., of Winnipeg, Man. Born at Winnipeg, Man., Dec. 12th, 1917. Educ.: B.Sc. (Elec.), Univ. of Man., 1940; 1939-40, dftsman. & junior engr., Anthes Foundry Ltd., Winnipeg; 1940, enlisted in R.C.O.C. as O.M.E., 1940-41, in training as an O.M.E. Officer, O.C., No. 29, L.A.D., 1942-43, Cdn. Liaison Officer, Fighting Vehicles Proving Establishment (British M. of S.); At present, Capt. & Technical Staff Officer, Grade III, R.C.E.M.E., Cdn. Military Headquarters, C.A. Overseas. (St. 1939).

References: F. F. Fulton, J. D. Relyea, W. L. Sagar, N. M. Hall, E. P. Fetherstonhaugh, C. V. F. Weir.

MOSESON—STANLEY GUSTAV, of 208 Lancaster Ave., Calgary, Alta. Born at Wetaskiwin, Alta., Jan. 2nd, 1916. Educ.: B.Sc. (Civil), Univ. of Alta., 1942; 1940 (summer), instru'mn., road diversion surveys dept., Dept. of Public Works (Alberta), Edmonton; 1941 (summer), concrete inspr., 1942 (summer), junior engr., & 1942-43, junior engr., later becoming field engr., i/c field work in connection with concrete structures & earth fill dam for storage project, Interlakes Storage Project, Calgary Power Co.; 1944 to date, engr., Fred Mannix & Co. Ltd., Calgary, Alta. (Student 1941).

References: P. Hargrove, L. A. Thorssen, R. S. L. Wilson, T. D. Stanley, J. N. deStein.

SCHNEIDER—REINHOLD ROY, Lieut. (E), R.C.N.V.R., of 3836 Eton Street, Vancouver, B.C. Born at Wolseley, Sask., Jan. 4th, 1918. Educ.: B.Sc. (Mech.), Univ. of Sask., 1941; 1941 to date, i/c of watch on active service. (St. 1942).

References: R. A. Spencer, I. M. Fraser, N. B. Hutcheon, W. E. Lovell, B. R. Spencer.

SIMPSON—JACK LLOYD, Lieut., R.C.E., of Edmonton, Alta. Born at Saskatoon, Sask., Feb. 20th, 1920. Educ.: B.Sc. (Civil), Univ. of Alberta, 1943; 1940 (summer), rodman, Dept. of Highways (Alberta); 1941 (summer), asst. driller, seismographic survey, Imperial Oil Ltd.; 1942 (7 mos.), instru'mn., & 1943 (3 mos.), junior highway engr., Public Roads Administration, Alaska Highway; 1943 to date, Engineer Works Officer, No. 13, E.S. & W. Coy., R.C.E., Red Deer, Alta. (St. 1943).

References: R. S. L. Wilson, I. F. Morrison, R. M. Hardy.

SUTHREN—JOSEPH WILLIAM, of Brownsburg, Que. Born at Welland, Ont., Oct. 4th, 1913. Educ.: B.Eng. (Mech.), McGill Univ., 1936; 1933 (summer), junior chemist, 1934 (summer), steel inspr., Cdn. Tube & Steel Products; 1935 (summer), junior engr., Plymouth Cordage Co., Welland, Ont.; With the C.I.L., Brownsburg, Que., as follows: 1936-37, dftsman., 1937-38, works development engr., 1938-40, tech. asst. to supt. of shot shell mfg., 1940-41, supervisor of shot shell & loading group of depts.; 1941 (8 mos.) shift supervisor, 1941-42, genl. shift supervisor, 1942-44, senior supervisor, D.I.L., Brownsburg; 1944 to date, senior supervisor of ammunition production, C.I.L., Brownsburg, Que. (St. 1936).

References: E. L. Johnson, C. H. Jackson, J. B. Francis, J. W. Houlden.

TAIT—ERIC, of 15 Springfield Ave., Westmount, Que. Born at Edinburgh, Scotland, Feb. 15th, 1916. Educ.: B.Eng. (Civil), McGill Univ., 1939; 1935 (summer), forestry, Munich, Germany; 1936 (summer), asst. to res. engr., road bldg., Rouyn, Que.; 1937 (summer), dfting., Three RiversTerminal Station, 1938 (summer), designing & dfting., 1939 (summer), instru'mn. & field work, La Tuque, 1939-40, concrete design, etc., for by-pass & power house, 1940, elec. wiring & mach. layout, La Tuque Power Development, Shawinigan Water & Power Co. Ltd.; 1941 (5 mos.), Asst. Mtce. Engr. Officer, No. 4 B. & G. School, R.C.A.F., Fingal, Ont.; 1941-42, design & detail, Arvida, 1942-43, reinforced concrete design, Isle Maligne, Que., 1943-44, design & layout, steel tanks, piping, etc., alumina plant, Muri Junction, India, Aluminum Co. of Canada; 1944-45, structural design engr., G. Lorne Wiggs & Co., Montreal, Que. (St. 1938).

References: G. Lorne Wiggs, J. G. Frost, J. A. McCrory, R. E. Heartz, S. R. Banks, S. H. Clarke.

TIVY—ROBERT HARRISON, Elec. Lieut., R.C.N.V.R., of Halifax, N.S. Born at Rivers, Man., June 23rd, 1921. Educ.: B.Sc. (Elec.), Univ. of Man., 1943; 1940 (3 mos.), concrete inspn., dfting., genl. bldg. inspn., 1941 (5 mos.), estimates, levelling, airport constrn., Dept. of National Defence, Rivers & Brandon; 1942 (4 mos.), training in the operation of various mach. tools., Cdn. Locomotive Co. Ltd., Kingston, Ont.; 1943-44, Gyro Base Mtce. Officer, Sydney, N.S., 1944 (3 mos.), Asst. Gyro Base Mtce. Officer & at present Gyro Base Mtce. Officer, H.M.C. Dockyard, Halifax, N.S. (St. 1942).

References: E. P. Fetherstonhaugh, A. V. Wells, J. Deane, A. E. Macdonald, N. M. Hall, E. R. Love.

VALIQUETTE—MAURICE-LOUIS, of Sorel, Que. Born at St. Laurent, Que., Feb. 4th, 1917; Educ.: B.A.Sc., C.E. Ecole Polytechnique, 1942; 1938 (summer), instru'mn., topogl. survey, 1939-40 (summers), dftsman., preliminary location survey on dam, Quebec Streams Commn.; 1941 (summer), tech. ap'ticeship., Hollinger Consldt. Gold Mines Ltd., Ross Mine, Holtyre, Ont.; 1942 (summer), field engr., Sullivan Consldt. Gold Mines Ltd., Sullivan, Que.; 1943, observer, lab. dept., Sorel Industries Ltd., Sorel; 1943 to date, engr. i/c ship's constrn., Marine Industries Ltd., Sorel, Que. (St. 1938).

References: J. A. Lalonde, A. Circe, H. Gaudefroy, E. Mackay, E. Gohier.

WEBSTER—JOHN ALEXANDER, Capt., of Ottawa, Ont. Born at Montreal, Que., Mar. 31, 1918. Educ.: B.Eng., McGill Univ., 1942; R.P.E. Que.; 1937 (summer), mtce. of substations & constrn. of L.V. trans. lines, 1938 (summer), power surveys & dffting., C. & D. Dept., Shawinigan Water & Power Co.; 1939-40, engrg. & constrn., La Tuque Power development, 1940 (summer), dfting. & design, Shawinigan Engrg. Co., Montreal; 1941 (summer) repair shop, Three Rivers, Shawinigan Water & Power Co.; 1942-44, design & supervn. of mfg. of new & improved electronic devices for use of Canadian, British & Allied Armies; At present, Asst. to Officer i/c Measurements & Tests Divn., Cdn. Signals, Research & Development Establishment, Ottawa, Ont. (St. 1942).

References: J. A. McCrory, R. E. Heartz, C. V. Christie, H. W. Lea, R. E. Jamieson.

FOR TRANSFER FROM AFFILIATE

CHAUSSE—PIERRE MAURICE, of Montreal, Que. Born at Letellier, Man., Aug. 1st, 1895. Educ.: 1938-42, Royal Provisional School for Engineers (Cdn. Army) Commissioned Engr. Officer, R.C.E.; 1914-16, asst. plant supt., switchbd. & cable work, Dominion Elec. Protection Co.; 1917-20, design & constrn., underground conduit system, City of Montreal; 1920-31, chief dftsman enlargement, Montreal waterworks; 1931-35, supt., elec. divn., 1935-37, tech. adviser, power & lighting contract, & 1937 to date, elec. technician, tech. divn., City of Montreal. (Affil. 1934).

References: deGaspe Beaubien, H. A. Gibeau, C. J. Desbaillets, G. E. Templeman, F. Y. Dorrance, J. F. Brett.

LIBRARY NOTES *(Continued from page 207)*

for students in the branches of industrial chemistry utilizing the products discussed.

HANDBOOK FOR SHIPWRIGHTS

By H. F. Garyantes. McGraw-Hill Book Co., New York and London, 1944. 602 pp., illus., diagrs., charts, tables, 9 x 5¾ in., cloth, $5.00.

This comprehensive training guide is intended to explain to the student or mechanic the fundamentals of the work of the shipwright in connection with steel hulls of present-day design. It begins with a preview of mathematics and geometry. Several chapters are devoted to ship's lines, tools, ropes, fastenings and the effects of welding, shoring, fairing and staging. In the rest of the book a sequence of operations is carried through from the laying of the keel to the launching of the ship.

HIGH-SPEED COMBUSTION ENGINES: Design, Production, Tests

By P. M. Heldt. (12 ed. of The Gasoline Motor) publ. by the Author, Nyack, N.Y., 1944. 776 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $7.50.

This standard work, now in its 12th edition, provides a comprehensive reference book for engineers as well as a textbook for students. The separate working parts of the high-speed combustion engine are covered in detail, including chapters on the carburetor and ignition equipment not previously included. Theory, design principles, production practice and operation are all given consideration, and two chapters are devoted to engine tests and the thermodynamic laws.

HIGHER SURVEYING

By A. L. Higgins. Macmillan and Co., New York and London, 1944. 463 pp., illus., diagrs., charts, tables, 9 x 5¾ in., cloth, $5.00.

The student is assumed to be acquainted with such elementary operations as chain surveying, levelling, traversing and plane tabling. On this basis the author proceeds to deal successively with engineering surveys, photogrammetry, field astronomy, geodetic surveys, and finally with the errors which are inherent in surveying practice and how they may be controlled. A series of practical questions and problems is included.

PEACE, PLENTY AND PETROLEUM. (Science for War and Peace Series.)

By B. T. Brooks. Jacques Cattell Press, Lancaster, Penna., 1944. 197 pp., maps, charts, tables, 7¾ x 5¼ in., cloth, $2.50.

Following a brief historical survey of the American petroleum industry, the author devotes several chapters to the importance of petroleum in our industrial economy with particular reference to war needs. Petroleum substitutes are discussed, and the geographical distribution and political implications of petroleum deposits are thoroughly covered. The author emphasizes the steady decrease in new producing areas in the United States and discusses the problems arising in connection with the increase in our need for foreign oil.

METALS AND ALLOYS DICTIONARY

By M. Merlub-Sobel. Chemical Publishing Co., Brooklyn, N.Y., 1944. 238 pp., 8¾ x 5½ in., cloth, $4.50.

Over 10,000 useful metallurgical terms are contained in this reference volume: definitions of metallurgical terms; compositions, properties and uses of all important commercial alloys; physical constants and properties of the chemical elements; brief descriptions of machinery and processes used in modern metallurgy; etc. Many trade names are included.

RADIO'S 100 MEN OF SCIENCE, Biographical Narratives of Pathfinders in Electronics and Television

By O. E. Dunlap. Harper & Brothers, New York and London, 1944. 294 pp., illus., 8¾ x 5¾ in., cloth, $3.50.

The brief biographies in this readable book cover a wide field. The first section is devoted to pioneers of electricity, from Thales of Miletus to Mahlon Loomis. The second section traces developments in radio and electronics from Hughes's invention of the microphone to the present day. The sketches are good and are in many cases based on personal acquaintance. Nearly one-half of the men are living. Portraits of almost all of them are included.

ROCKET RESEARCH, History and Handbook

By C. P. Lent. Pen-Ink Publishing Co., New York, 1944. 102 pp., illus., diagrs., charts, tables, 9¼ x 6 in., stiff cardboard, $5.00.

The early history and present status of the development of rocket and jet propulsion are well presented in this small volume, The author covers both theory and practical application, including descriptive material on the various types of weapons brought out by the war. The text is illustrated by more than one hundred photographs and diagrams, and some 150 American and British patents are listed.

SHEET METAL, Theory and Practice

By J. C. Butler, drawings by L. O. Genereux. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1944. 173 pp., illus., diagrs., charts, tables, 11¼ x 8¼ in., cloth, $3.00.

This concise, practical self-instruction guide gives methods for handling successfully tools and machines, material allowances, blueprint reading, soldering, fluxes, welding and riveted assembly as used in sheet-metal shop practice. The material was originally prepared as a training programme in marine sheet-metal work, and the emphasis is on marine applications.

SOLVENTS (Monographs on Applied Chemistry, Vol. 4).

By T. H. Durrans. 5th ed. rev. & enl., D. Van Nostrand Co., New York, 1944. 202 pp., diagrs., charts, tables, 8¾ x 5¼ in., cloth, $6.00.

The first part of this book deals with scientific fundamentals: solvent action, solvent power, plasticising solvents, solvent balance, viscosity, vapour pressure and evaporation, rates, inflammability and toxicity. The second part deals comprehensively with individual solvents, mainly with the view of facilitating intelligent use of them in the cellulose-lacquer industry. A table of solubilities and a dictionary of trade names are appended.

Employment Service Bureau

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. 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. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.

NOTICE

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 is—

(a) unemployed;

(b) 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.

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GRADUATE CIVIL OR MECHANICAL ENGINEER wanted. See page 53 of the advertising section.

DRAUGHTSMEN AND ENGINEERS, Mechanical, electrical and concrete draughtsmen and designers wanted by pulp and paper company. Apply to Box No. 2890-V.

GRADUATE MECHANICAL ENGINEER for post-war position, age about 35 with production and executive experience required by internationally-known firm of manufacturers of steel building products, to act in senior plant position in U.S.A. Successful candidate must be adaptable, desirous of co-operating in development of new products and production of same, and preferably with some experience in handling labour. Present purpose is to establish contact with suitable applicant with a view to prompt action when regulations permit. Apply to Box No. 2901-V.

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POST-WAR POSITION IN ENGLAND for an experienced executive with sales engineering background, preferably including export work, with a well-established, internationally-known firm of steel building products manufacturers. Senior position overseas. Desirable age limit 37-42 years. Position will require ability, tact, vision, enthusiasm and hard work. Present intention is to establish contact now with suitable applicant, although overseas move will not be made till war conditions permit. Some months of familiarization with future duties would be arranged for at a U.S.A. point. Apply to Box No. 2900-V.

ELECTRICAL SALES ENGINEER for western firm specializing in engineering sales and service of all types of electric machinery and similar equipment. The position would be permanent and on a salary basis. Applicants should state: training, experience, age, nationality and availability. Apply to Box No. 2911-V.

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UNIVERSITY GRADUATE with 20 years' varied experience in mechanical, structural and chemical engineering on design, construction, maintenance, operation and management of pulp and paper mills, railroads, steamships and public utilities available on short notice for senior responsible position. Apply to Box No. 423-W.

MECHANICAL ENGINEER, JR.E.I.C., JR.A.S.H., & V.E., B.SC. 1936. Age 30, married. British nationality; Canadian citizenship. Experience includes four years on design, test work and sales engineering with manufacturers of complete line of fans and air handling equipment, as well as domestic and commercial heating and air conditioning equipment; one year lecturer and demonstrator in mechanical engineering at leading Canadian University; two years engineer in charge of grey iron foundry in large metal industry; two years on industrial ventilation and dust control problems, including design, experimental and development work principally on gas and dust scrubbers. Ontario location preferred. At present employed and on military postponement, but services available under regulation PC 246 Part 3, administered by W.B.T.P. Apply to Box No. 1484-W.

CHEMICAL ENGINEER, seven years' experience on production and inventory control; distillation, solvents, analysis. Available under W.B.T.P. regulations. Now residing in Montreal. Apply to Box No. 1827-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., R.P.E. (Ont.) 35 years of age, 10 years' general contracting experience; 6 years sales engineering and executive experience with manufacturer of construction materials. At present holding commission in R.C.A.F. Works and Buildings branch, desires contacts in construction field for employment in near future. Apply to Box No. 2471-W.

GRADUATE ENGINEER, M.E.I.C., R.P.E. (N.B.) with 30 years practical experience in design and construction of industrial plants, reinforced concrete, steel, timber, steam heating, water supply installation, sewerage, wharves and docking facilities, quantity and cost estimates. At present holding position of responsibility, seeks position of responsibility with industries which contemplate building or expanding. Apply to Box No. 2472-W.

CIVIL ENGINEER, executive, M.E.I.C., recently completed tropical contract, seeks new connection Canada or abroad. Twenty-five years' engineering and executive experience. Clean record and best of references. Available immediately. Apply to Box No. 2474-W.

ELECTRICAL ENGINEER, M.E.I.C., P.E.Q., 37, married; experienced in industrial plant design, layout, alterations and construction, application of motors and control, also considerable mechanical experience. City of Montreal preferred, presently located in Ontario, available on one month's notice. Apply to Box No. 2475-W.

FOR SALE

Tyco compensated aneroid barometer reading to 5,000 ft. or 31" of mercury. Apply to Box No. 57-S.

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CONTENTS

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COVER PICTURE

The cover picture shows a bulldozer tractor levelling out rough ground somewhere near the front.

(British War Office Photograph).

FARM ELECTRIFICATION—A NEW SCIENCE

J. W. TOMLINSON

Assistant General Superintendent, Manitoba Power Commission, Winnipeg

Paper presented at the Fifty-Ninth Annual General Professional Meeting of The Engineering Institute of Canada, at Winnipeg, Man., on February 7th, 1945.

Canada's economy depends upon half the population living in rural areas and we must find ways and means of keeping the standard of living in rural areas not too far behind that of towns and cities if we are to keep some of the younger generation in the rural areas. It is becoming evident that central station power is the most powerful single instrument in raising the standard of living on a farm. Apart from all the common uses which come to our minds such as lighting, radio, refrigeration and power for a dozen jobs around the farm-yard, electric power makes automatic pressure water systems feasible, which in turn make modern plumbing possible. It has been reliably estimated by farm rehabilitation authorities that, where adequate electric power is available on the farm, every dollar spent upon farm rehabilitation will get double the results.

In the next decade, the "other half of the population" is going to get electric service. While there will be a place in this programme for individual wind-electric plants, gasoline and oil engine plants, etc., for the vast majority, central station power is the final answer. The sooner governments, manufacturers and utilities get their engineers together to devise ways and means of accomplishing this, the less money will be wasted on inadequate alternatives which will not satisfy but will impede the final plan which depends so much on high saturation of the farms in any area to make it practical.

Bringing the multiple benefits of central station electrical service to Canadian farms is so different to serving towns and cities, that it should be treated as a separate specialized branch of electrical engineering.

It was more or less natural that rural electrification should have been begun by extending city feeders out into the surrounding farm areas. This has served a very useful purpose as a demonstration or test to show the rural population the many very beneficial uses for electricity on the farm. However, now that this stage is past and farm electrification is recognized as a necessity rather than a luxury, having farm electrification handled by city utilities who have, by necessity, adopted city standards and methods of construction, can become a great handicap.

There are several major differences between these two branches of power distribution. They are closely related, but while they may be sisters, they are not twins. First there is the problem of economics, or financing. In the past, annual revenues have been called upon to pay 6 per cent interest, provide a replacement or sinking fund to pay off the debt in twenty years, and establish a depreciation reserve to assure that, at the end of twenty years, the system will still be as good as new. This may have been justified in part when the industry was experimental but it gives to the next generation a complete system, free, without debt, and generally good for at least another twenty years.

It would appear that the average life of distribution equipment is well over twenty-five years. If the borrowed money is paid off in twenty-five years so that a new system can be financed at that time, the next generation should be satisfied, even if the old system is worn out or obsolete. This type of financing would call for less than half the return on the dollar invested; thus lines could be extended twice as far per dollar revenue. We sincerely hope that utilities will revise their financing for farm electrification. City revenue has been able to stand the strain, whereas rural electrification cannot, and still be practical.

Another difference is that types of equipment ideal for farm lines are often radically different from those required for city feeders; for example, hardware, anchoring, transformers, oil circuit breakers, span lengths, etc. The 150-ft. span, while ideal where houses are 50 ft. apart, just means higher first cost and more poles to straighten, fire guard, and replace, when used on farm lines. The size of conductors used on farm lines was influenced for many years by the sizes made and stocked for city or town use. In cities, we deal with load currents of hundreds of amperes, on farms we deal with fractions of amperes. In cities network, capacity results in short circuits of hundreds of thousands of kva.; in farm networks, impedance of transformers and lines generally limits the fault capacity to one or two thousand kva. In cities or even towns, one mile of primary will serve about one hundred customers. On farm lines in the prairie provinces, one mile will, on the average, serve two customers.

The types of construction crews and their equipment, even the mental processes of the engineers, inspectors and management are different, and cannot readily be changed to incorporate the fundamental differences between city and rural distribution.

The above are cited to show that these two "sisters," while related, are vastly different, and that farm electrification cannot successfully be handled by slightly modified city methods. To make it a success in the prairie provinces, or anywhere where saturation is only two customers per mile, every utility intending to serve farm load should delegate an engineer, preferably a junior engineer, to study the subject, especially the results of experiments already conducted by others. He would thus prepare himself to attend a conference of as many specialists in this line as possible to pool experiences and draw up uniform standards so that the best overall results can be obtained at the least cost. In the above mentioned type of farm electrification, there is no margin for error; both the utility and customer will suffer unless most of the weaknesses are eliminated at the start.

In our study of farm electrification as a post-war programme for Manitoba, we have concluded that it is very necessary to keep an open mind. Every suggestion, no matter by whom it is made, or how revolutionary, must be considered in the light of the needs of farm electrification. Necessity is the mother of invention and a cheaper way will always be found to do things if we cannot afford the method in vogue. For this reason, I would like to pass on to those interested in this specialized line a few necessities, and in some cases possible solutions.

New Conductors

The first requisite for farm line conductors is high tensile strength, the second is durability; (low resistance is a prerequisite for a "conductor"). We have two low cost metals, copper and aluminum which are good conductors, but neither has high tensile strength. Steel is a relatively poor conductor but has high strength and durability. To combine some of these characteristics, composite conductors have been used wherever longer spans were desirable.

TABLE I

PHYSICAL CHARACTERISTICS OF CONDUCTORS

Metal	Strength Tensile psi.	Moduli of Elasticity psi.	Weight 1,000,000 CM per 1000 ft.	Resistance 1 CM ft.	Temp. Coeff. Per deg. F.
Steel	180,000	30,000,000	2640	111,007	0.000,0064
Copper	65,000	16,000,000	3027	10,692	0.000,0093
Aluminum	26,000	10,000,000	920	17,002	0.000,0128

If the reinforcing material were similar to the current carrying material in respect of modulus of elasticity, coefficient of thermal expansion, corrosion resistance, and electro-chemical potential, no difficulty would be experienced. The characteristics of the metals at present in general use in conductor design are shown in Table I. Dissimilar mechanical characteristics, such as moduli of elasticity, and temperature coefficient result in variable internal stress distribution. In this respect, there is less difference between copper and steel than between aluminum and steel so that, physically, C.C.S.R. (copper cable steel reinforced) is better than A.C.S.R. (aluminum cable steel reinforced).

The corrosion problem where two electro-chemically dissimilar metals are in contact has received much study and research by experts in all countries, and is still an important factor in the planning of long life projects, but in prairie farm country the atmosphere is relatively pure and we can rest assured that other factors unless improved will wear out the conductor before corrosion causes failure. However, in coastal areas or factory districts where contamination exists, ordinary steel reinforced cables will not last twenty-five years without seriously reducing the factor of safety. In Europe where both A.C.S.R. and C.C.S.R. have been used for ten years, the evidence is that the corrosion problem is more serious with A.C.S.R. than with C.C.S.R. American experience with A.C.S.R. has been satisfactory as far as corrosion is concerned, so perhaps this hazard has been overemphasized.

A more prominent hazard to the long life of transmission line conductors is vibration fatigue. Because of excessive temperature variation in Canada, the position of metals in the temperature coefficient tables is more important than their position in the electro-chemical series. Theoretically, when two metals are rolled, stranded, or clamped together they should have the same temperature coefficient of expansion so that they share the tension properly at all temperatures; otherwise at low temperatures one metal tends to assume all the tension, thereby becoming overstressed. Obviously the ideal conductor would have the strength, elasticity and temperature coefficient and durability of steel, and the conductivity per unit cost of aluminum. *An alloy approaching this should be the aim of modern metallurgy.* The prize would be worth the effort since half a million miles of this conductor could be used in Canada alone in five years after the war.

Copperweld conductors have achieved a method of making a composite copper-steel conductor which defies the temperature co-efficient and corrosion problem, but the fabrication costs are so high that the cost to the utility is around 300 per cent of the base metal cost.

Aluminum has always enjoyed a decided advantage in weight for equivalent conductivity and has been widely used in spite of its lack of durability. Its high temperature coefficient causes the aluminum strands (in A.C.S.R.) to assume all the tension at low temperatures. Because of its low tensile strength, the aluminum becomes stressed beyond its elastic limit, even though a liberal factor of safety was allowed for the overall cable in the design. The breaks occur at ties and clamps where the aluminum is subject to both bending and

TABLE II

PERTINENT CONDUCTOR DATA

Conductor	Strength	Resistance ohms per mile	Outside Diameter	Weight per mile 2 wires	Quantity Price	Cost per mile 2 wires
(Group A—2000 No. Class—Up to 350′ spans)						
3/13 Steel hard	1950	19	0.202	790	$11.60	$ 91.64
3/12 Copperweld (40%)	2040	7.20	.174	590	31.25	184.38
8A Copperweld	2240	3.50	.1995	810	23.75	192.38
6 C.C.S.R.	1935	2.234	.198	1005	21.05	211.55
6 Cond. No. 4 A.C.S.R.	1825	2.22	.250	625	23.11	144.44
(Group B—3000 No. Class—Up to 500′ spans)						
3/13 Steel crucible	3360	22.5	0.202	790	12.75	100.73
No. 8 Steel Crapo	2915	17.15	0.207	815	.....	......
9 C.C.S.R. 3 Cu. 4 St	3150	4.44	0.198	950	18.05	171.48
4 A.C.S.R. 150% strength	2705	2.22	.246	825	20.05	165.41
6A C.C.S.R.	3050	2.22	.248	1260	17.45	219.87
6A C.W.C.	2580	2.2	.230	1100	23.35	256.85
5A C.W.C.	3190	1.74	.259	1390	23.05	320.40
4 C.C.S.R.	3036	1.379	0.252	1615	19.95	322.19
4 Cond. No. 2 A.C.S.R.	2780	1.40	0.316	990	22.14	219.18
(Group C—River crossings and extra long spans)						
No. 6 Steel Crapo	4295	11.35	0.252	1220	.....	......
No. 9 Cond. Magpie A.C.S.R.	4170	4.44	.250	1015	16.75	170.01
4 A.C.S.R. 200% strength	3670	2.22	.253	1060	17.39	184.33
2 A.C.S.R. 150% strength	4130	1.40	.310	1310	19.28	252.57

TABLE III

COST PER MILE OF LINE (LESS CONDUCTOR)

Poles per Mile

	12	15	18	22	27	36
Poles and hardware	$195.54	203.43	236.35	282.89	341.07	450.24
Labour	79.00	89.75	100.50	115.00	133.00	165.00
Expense and overhead	70.93	78.14	88.51	103.31	119.12	149.79
Total cost less conductor	$345.47	371.32	425.36	501.20	593.19	765.03

tensile stress. The same phenomenon applies to C.C. S.R. to a lesser degree, but copper is more ductile, which relieves the overstress, and is also less subject to crystallization after bending.

In assuming a factor of safety for composite cables, it should be assumed that the cable is strung and clamped at say 90 deg. F., then cooled to 30 deg. F. (below zero) and then analyze the tension in each metal, and apply the factor of safety to the one most highly stressed.

Wartime use of steel as a transmission line conductor has opened our eyes to the possibilities of this low cost, high strength, durable conductor for use wherever higher resistance is permissible. Again we were slow to see its possibilities mainly because town and city feeders and city distribution voltages required low resistance. Investigation of steel as a conductor has brought to light that the resistance varies with type of steel, method of rolling, drawing, and galvanizing, Certain types show resistance as much as 20 per cent less than others, but are not obtainable in Canada at the present time.

Choice of Span Length

Table II gives pertinent data and the relative costs of conductor for a mile of farm line, using various types of conductors.

It should be remembered, however, that there are other costs in a mile of line, such as poles, labour, hardware, etc., and since certain conductors are more suitable than others for longer spans, it is sometimes good economy to invest more in conductors to save poles and labour. Table III is a comparison of costs for various numbers of poles per mile. When the number of poles is reduced below fifteen per mile, line design based upon 35-ft. poles is necessary to obtain adequate ground clearances.

A tremendous number of poles will be required for the post-war farm electrification construction on this continent and it will be well to conserve poles by choosing conductors suitable for longer spans. In the past, the ruling span for rural lines has been approximately 300 ft. The number of poles required can be reduced about 25 per cent by using a ruling span of 375 ft. The span lengths used in the design of rural lines has two governing factors, the strength of poles and the allowable sag for clearances.

Using 30-ft. Class 6 poles, a maximum span of 485 ft. is indicated by the strength of the pole (safety factor 2.0—see Table IV). However, to maintain adequate clearances on 30-ft. poles, a rural conductor with a tensile strength of 3,000 lb. is required. The sag should preferably be based on an optimum final sag at 45 deg. F. (mean temperature between -30 deg. F. and 120 deg. F.) which is determined by the apex of the sag—tension parabola. At this point the variations of tension and sag are most uniform. This, however, is controlled by two limits—(a) The ice loading condition which must not stress the conductor to more than 60 per cent of its ultimate strength, and (b) Initial stress at zero farenheit without ice loading must not exceed 30 per cent of ultimate strength.

This second limit is designed to prevent vibration and should be effective where all spans are nearly equal. There seems to be a critical ratio of sag to span length where vibration starts, regardless of tension. If some spans are shorter than the ruling span for which the line is designed, the conductors tend to vibrate at lower temperatures. In Manitoba, cold weather lasts long enough to break strands in short spans with certain types of conductors during the first winter after erection.

When longer spans are used on wood poles, a smaller coefficient of expansion is a distinct advantage since the variation in sag will be less. Thus steel has the advantage over copper, and both are better than aluminum.

Wherever vibration is a possibility, triangular configuration of the conductor is desirable, since it has been proved beyond doubt that smooth body conductors are more subject to vibration.

With the abundant post-war supply of aluminum, it behooves the aluminum metallurgists to produce an alloy which has a higher strength and can be hard drawn, even if some weight and conductivity are sacrificed. Otherwise the above considerations and shortage of poles will tend to discourage its use.

TABLE IV

CLEARANCE AND ALLOWABLE SAG USING 30-FT., POLES

Span length, ft.	200	250	300	350	400	450
Required clearance, ft.	18.5	19.0	19.5	20.0	20.5	21.0
Allowable sag, ft.	6.0	5.5	5.0	4.5	4.0	3.5

Choice of Voltage

Long study and experience has proved that 7200/12480 volt transmission is the most economical for thinly distributed loads up to 300 kva. and distances up to thirty miles. Table V shows the uniformly distributed load which can be transmitted various distances with different percentages of allowable regulation. Until these are tabulated, it is very difficult to realize the vast difference between 2300/4160 wye, and 7200/12480 wye systems. The ratio for single phase lines is nine to one, making it possible to transmit nine times as far at 6900 volt, single phase.

These charts are very handy in laying out farm networks to determine how far to extend three phase trunks or low resistance conductor single phase trunks, and which branches can be steel wire or other relatively high resistance conductors.

Assuming all the farms in an area will finally take service and that a good load building programme has

TABLE V

APPROXIMATE LOADING TABLE

Single Phase Lines

Voltage	Conductor	Kilowatt Miles Uniformly Distributed for Percentage of Voltage Drop				
		1%	2%	3%	4%	5%
6900	3/13 Steel No. 16 Cu.Eq.	24	48	72	96	120
	3/12 C.W. No. 12 Cu.Eq.	62	124	186	248	310
	No. 9 Cu.Eq.	100	200	300	400	500
	No. 8 Cu.Eq.	130	260	390	520	650
	No. 6 Cu.Eq.	200	400	600	800	1000
	No. 4 Cu.Eq.	300	600	900	1200	1500
	No. 2 Cu.Eq.	420	840	1260	1680	2100
	No. 1 Cu.Eq.	490	980	1470	1960	2450
4600	3/13 Steel No. 16 Cu.Eq.	10.7	21.4	32.1	43.8	53.5
	3/12 C.W. No. 12 Cu.Eq.	27.6	55.2	82.8	110.4	138
	No. 9 Cu.Eq.	44.5	89	133.5	178	222.5
	No. 8 Cu.Eq.	57.8	115.6	173.4	231.2	289
	No. 6 Cu.Eq.	89	178	267	356	445
	No. 4 Cu.Eq.	133	266	400	533	666
	No. 2 Cu.Eq.	187	374	561	748	935
	No. 1 Cu.Eq.	218	.436	654	872	1090
2300	3/13 Steel No. 16 Cu.Eq.	2.7	5.3	8	10.7	13.4
	3/12 C.W. No. 12 Cu.Eq.	6.9	13.8	20.7	27.6	34.5
	No. 9 Cu.Eq.	11.1	22.2	33.3	44.4	55.5
	No. 8 Cu.Eq.	14.5	29	43.5	58	72.5
	No. 6 Cu.Eq.	22.2	44.4	66.6	88.8	111.0
	No. 4 Cu.Eq.	33.3	66.6	99.9	133.2	166.5
	No. 2 Cu.Eq.	47	94	141	188	235
	No. 1 Cu.Eq.	55	110	165	220	275

built up the average consumption to 200 kwh. per month, the diversity should result in an average demand per farm of 1.0 kw. for branch lines, and 0.75 kw. for trunk lines, and a totalized demand of 0.5 kw. on substations. On this basis, if a farm line has a density of two customers per mile, 3/13 steel wire (copper equivalent No. 16) can be extended six miles from a 6900 volt substation with only 3 per cent voltage drop in the line.

If the same branch line were served at 2300 volts, the conductor would have to be equivalent to No. 6 B & S. Reference to Table II shows an increase in conductor cost of over $100 per mile.

Grounding

Based upon present practice, it seems a foregone conclusion that farm lines will be single phase grounded vertical type. Necessity for economy dictates star connected substations and distribution transformers in order to keep the voltage class down to the minimum. Long experience in rural electrification serving towns and villages has indicated that the overall safety is greater when all grounds are inter-connected. This results in a common neutral system, and when applied to farm electrification will cover large areas within which considerable variation of ground resistance is to be expected.

The net ground resistance of the common neutral which is safe for farm lines is a very important question. The relative safety of a grounding system is generally judged by how much potential can or will be built up on the neutral; but the hazard is actually due to the potential gradient between any two points between which a person or animal can come in contact.

The Rural Electrification Administration in the United States recognizes that the problem is one of potential gradient and has made studies and tests to evolve methods of controlling the gradient, both by reducing the resistance of ground rods and by "spread electrodes" to reduce the gradient where resistance is high. The hazard from high resistance earth contact or earth return path depends upon possible potential gradient under short circuit conditions. By covering the ground wire down the pole the problem becomes one of potential gradient in the earth surrounding the electrode. Figure 1 shows the decrease in gradient obtained by spreading three ground rods in a 10-ft. triangle. There is no gradient within the triangle, and much less per foot outside the triangle than when a single electrode with the same resistance is used.

All regulations, safety codes, and approved practices are based upon conditions in towns and cities where conditions are entirely different. The National Safety Code (U.S.A.) calls for individual electrode resistance below 25 ohms, but does not specify the net resistance of common neutral systems, which is the true criterion.

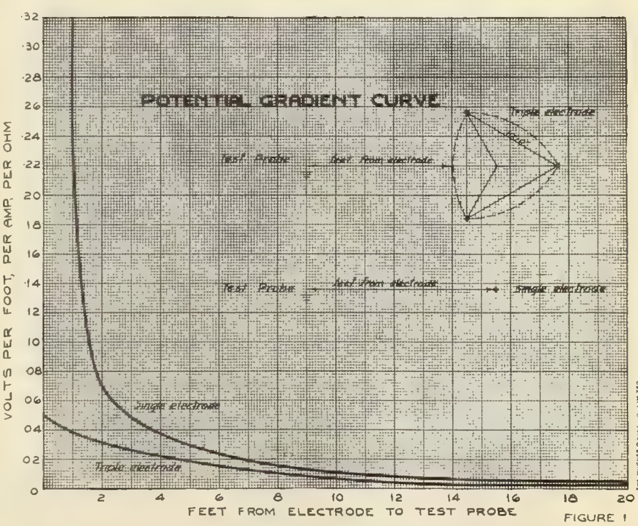


Fig. 1—Potential gradient curve.

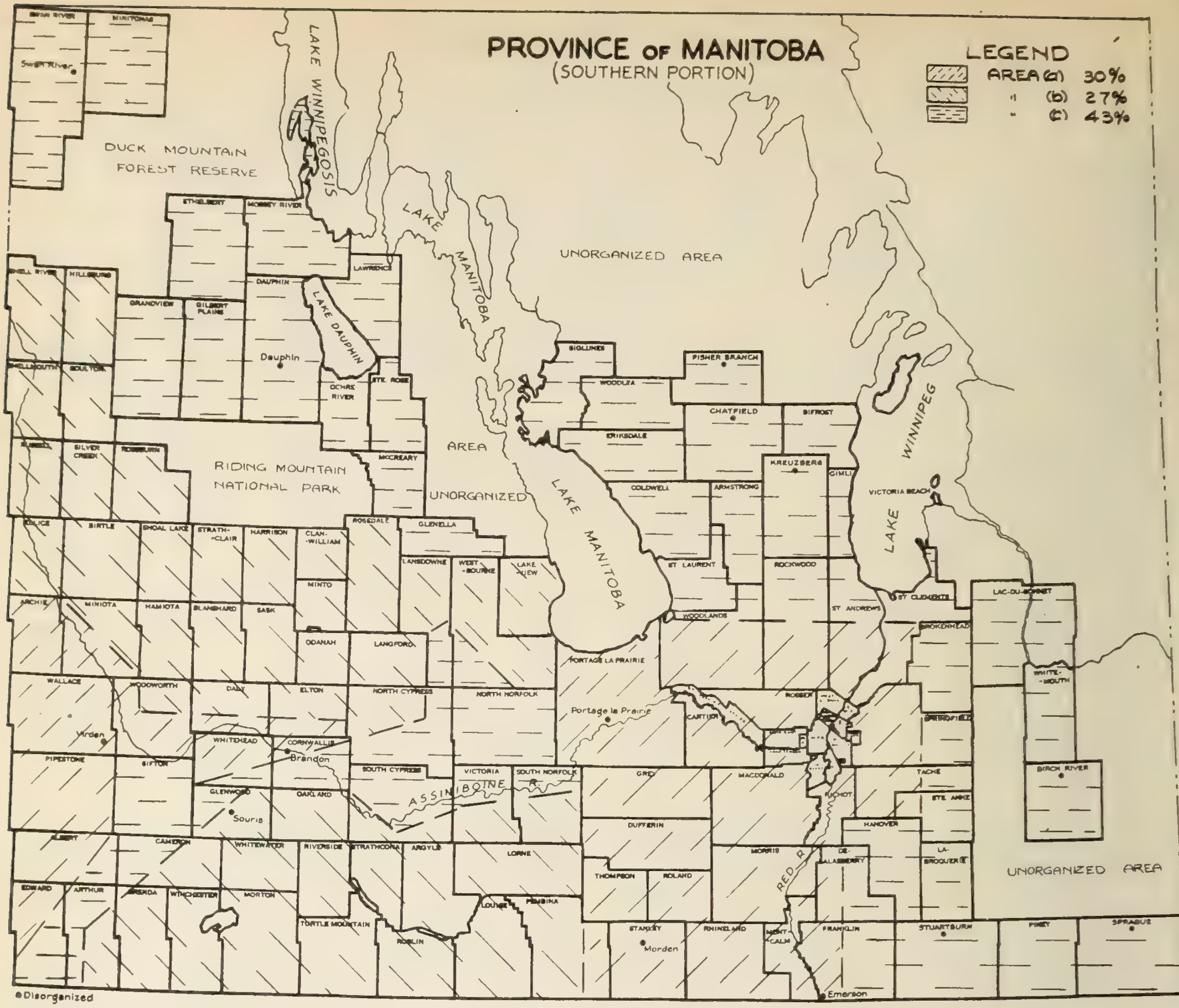


Fig. 2—Map showing geological formation of soils and subsoils of Manitoba.

It is generally accepted that if the product of net resistance in ohms of the common neutral return multiplied by the ampere rating of the line sectionalizing fuse or oil circuit recloser is below 150, the system would be acceptable. However, since many different utilities will be engaging in farm construction in areas of varying soil conditions, suitable regulations should be drafted by rural electrification engineers, governing standards for grounding.

In studying this problem in Manitoba, we have come to the conclusion that accurate soil survey data is necessary to determine areas where various types of construction and grounding are adequate. Figure 2 is a Department of Agriculture map showing the geological formation of the soils and subsoils of Manitoba. Ground tests during the past twenty years, supplemented by additional tests recently, indicate that except for small local areas this map shows the subsoil conditions accurately enough so that we can predict that in agricultural areas the ground resistance will fall in three groups.

(a) Approximately 30 per cent of the farm area where single 10-ft. iron rods will average less than 10 ohms. Three rods per farm will average less than 5 ohms.

(b) Approximately 27 per cent of the farm area where single rods will average less than 25 ohms and three rods will average less than 10 ohms.

(c) Approximately 43 per cent of the farm area where single rods will likely average over 25 ohms.

We find that area (a) contains approximately 15,600 farms and will involve over 10,000 miles of farm line. In this area it is obvious that the earth return will be of much lower resistance than the line neutral and will actually transmit the major part of the return current. Under these conditions, magnitude and duration of hazardous potentials would be reduced far more by duplicate electrodes at the farm than by stringing a high cost neutral wire, several miles long, which may be broken, torn down, or burned off in any one of a hundred or more spans.

Statistics indicate that there are over one thousand miles of actual single wire rural lines in use in various parts of the U.S.A. and Canada, which have given perfectly satisfactory service. This type of line is only satisfactory where ground resistance is low and where ground contact can be relied upon.

In area (b), the choice lies between interconnecting the electrodes at various farms by running a continuous low resistance neutral or by installing multiple spread electrodes at the farms and substation to bring the resistance down to five ohms.

Area (c) requires a continuous low resistance neutral and if low common neutral resistance cannot be obtained by multiple or treated electrodes, it may be necessary to isolate the primary neutral.

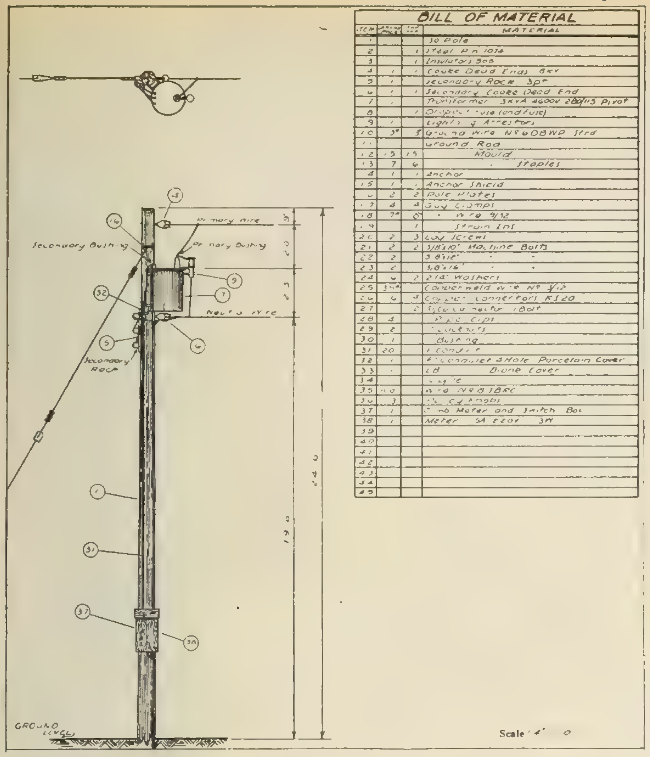


Fig. 3—Farm service pole.

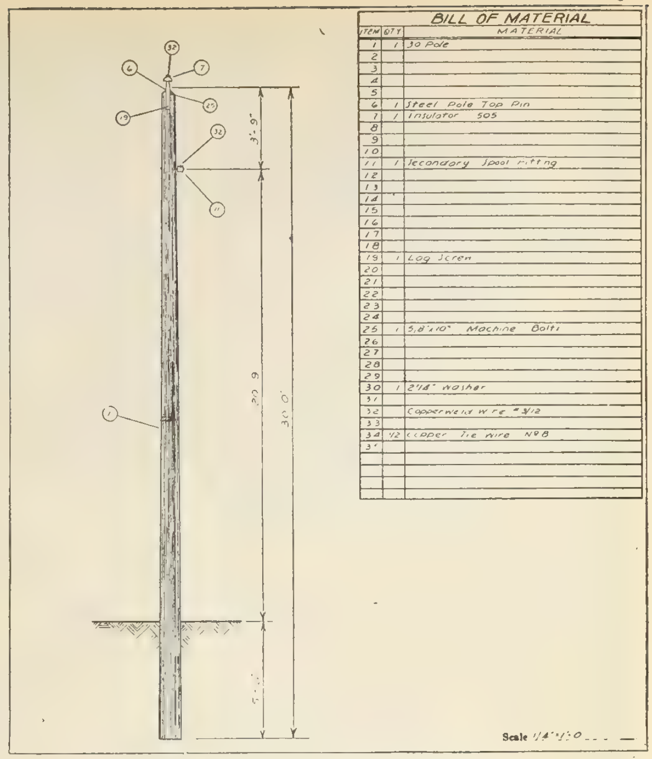


Fig. 4—Standard farm line pole.

In attempting to evaluate the claim that ground rods alone cannot be relied upon during dry cycles and winter conditions, we find that in the flat prairie country in areas (a) and (b), even when the top soil is too dry to grow a crop, the subsoil is still quite moist. Frost often penetrates five feet in Manitoba, that is why a 10-ft. rod is used. Our studies also revealed that even if the ground rod resistance doubled when the ground was frozen there is very little hazard from potential gradient in the ground around the rod since frozen earth is an excellent insulator, so that potential gradient does not appear on the surface where persons or animals can contact it. Statistics also show that line and transformer faults very rarely occur in the winter, due to the absence of lightning storms and tree troubles.

In considering the above hazards it should be kept in mind that wherever farm animals have received electrical shock and a thorough investigation has been made it has seldom been found that primary current was involved. In almost every case the potential came from 115 volt wiring. In many cases it was traceable to defective wiring due to excessive moisture and in some cases due to lightning damage at some previous time.

The presence of moisture, ammonia fumes and exposure to lightning makes city wiring standards inadequate for use on the farm. Metallic covered wiring such as conduit and flexible armoured cable were devised for and have served well in cities, but are most unsatisfactory on the farm, except possibly in the house. Conduit service entrances, designed to prevent theft of energy in cities, are neither desirable nor necessary on farms. They are not desirable because of moisture condensation in outbuildings and susceptibility to undetected lightning damage. They are not necessary since metering on the pole, instead of inside each building, is much more economical and practical where several buildings are served.

Non-metallic outlet boxes and switch covers would complete the safe, rustless farm wiring installation. New, simple wiring regulations are required, drawn up by committees who understand both the special hazards and the need for economy and ruggedness in farm wiring.

Standardization

The results obtained by the Rural Electrification Administration in the U.S.A. by standardization of pole line hardware transformers, metering, etc., are well known. The need for standardization in Canada is realized by both manufacturers and utility men. The difficulty in the past has been that growth of utilities has been spasmodic and unpredictable. However, although farm electrification has been proceeding for some time in various parts of Canada the big programmes will be a post-war feature.

This gives us a golden opportunity to get together while we are waiting and by all using similar items, we will get a much better product for the same cost, or the same standard at a lower cost to the people of Canada.

In spite of past experience, the prairie provinces have great faith in co-operation. Perhaps it is because we are all faced with what is considered an impossible problem, that we have got along so well. Standardization of a rural type distribution transformer, has resulted in both publicly and privately owned utilities obtaining a much better transformer, both electrically and physically, at a lower price. A combination meter and thermal switch box has been developed for erection on the service pole at approximately half the prewar cost of meter box and main switch. Interchange of practical field experience has reduced to a minimum the overall cost of the farm line and service installation. Continued interchange of actual experience with test areas will ensure the utilities of minimum operating costs and, the people of the prairies, maximum service per dollar expended.

The development of a low cost single pole oil circuit recloser for small loads and line voltages up to 15 kv. is proving to be one of the most outstanding contribu-

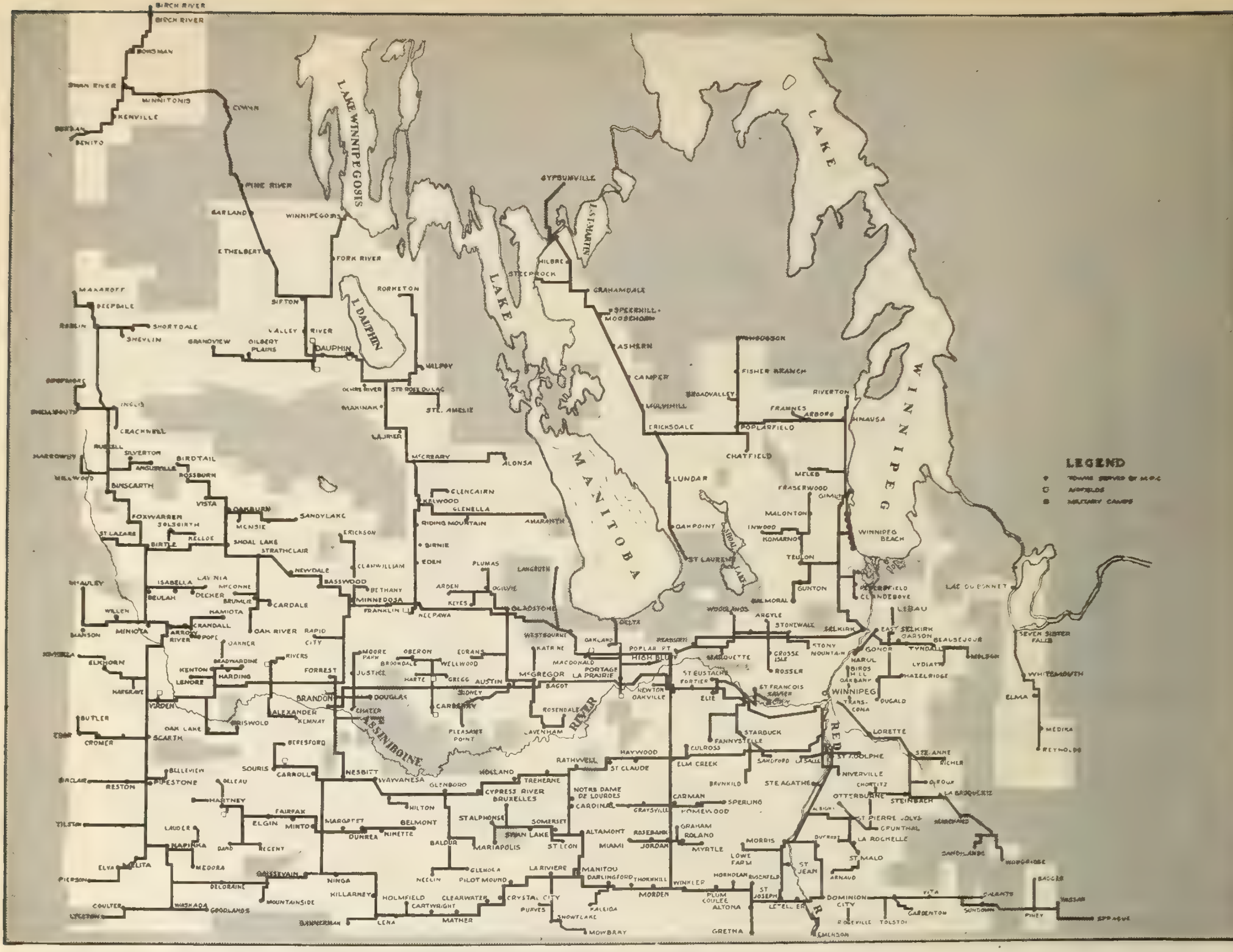


Fig. 5—Proposed Manitoba Farm Electrification Service area, tributary to Manitoba Power Commission extended network.

tions to rural electrification. Operating reports to date indicate that 92 per cent of all rural line trip-outs are handled by these three shot reclosers without lockout. This means that one of the largest operating expenses, going over lines replacing blown fuses on branch lines, will be greatly reduced and the customer will get much better service without duplicate lines or loop feeds. Many wartime developments in the field of plastics, alloys, wireless communication and power operated construction equipment, when released, will be received with an open mind by farm electrification engineers. It is our duty to keep the standard of service and safety as high as possible consistent with sound economics, but it is not necessarily our duty to make it so safe or so high a standard that its use is denied to 50 per cent of the population. Highways are safer and better with two traffic lanes, but farm roads are not built that way, and although relatively dangerous, are better than no road at all.

The foregoing description of some of the problems of rural electrification, does not by any means exhaust the list. They are illustrative only. We must view all obstacles as challenges and not accept any difficulty as impossible of solution if we are to prove that the benefits of central station electric service are to be extended to the vast rural areas.

DISCUSSION

PROFESSOR ANDREW STEWART[1]

As a non-engineer, interested in the problems of farm electrification, Professor Stewart found Mr. Tomlinson's paper encouraging as giving so much evidence of careful investigation and enquiry. His comments would relate to some general aspects of the problem, some of which the author had touched on in his opening section.

(1) Referring to the statement that "in the next decade, the 'other half of the population' is going to get electric service", Professor Stewart, in speaking to public audiences on the subject of farm electrification in Alberta, would like to be able to make a positive statement to the effect that the 'other half of the population' would get electric service in the next ten years, but he did not feel that he could take responsibility for such a statement. His reasons were as follows. In the first place, the available information suggests that the mileage of farm line constructed in 1945 will be small because of acute material shortages. Secondly, some of the shortages may well extend into 1946 and 1947. Thirdly, it will take time to develop the organization necessary to undertake a full-scale programme of line construction. Fourthly, even with a full programme under way in the pro-

[1] Department of Political Economy, University of Alberta, Edmonton.

vince of Alberta it does not seem reasonable to expect that more than 3,000 farms will be connected in only one year. Fifthly, in view of the uncertainties of the post-war period it seems advisable to discount the most optimistic predictions.

(2) Professor Stewart did not share the author's view that "for the vast majority, central station power is the final answer". He believed that, in any general scheme of farm electrification on the prairie provinces, the individual farm plant will occupy a more important place than Mr. Tomlinson's statements imply.

He felt that a programme of complete electrification would take longer than ten years, so that there will be many farmers who may not expect to be served with central station power for at least that period of time. In Professor Stewart's opinion, there is no reason to discourage them from installing farm plants. By this means they will get substantial immediate advantages; and, as long as conditions are such as to favour extension of farm lines, there will be a ready market for used or reconditioned plants.

Second, under present conditions and under conditions which can reasonably be expected, there appear to be many areas in the prairie provinces in which, after considering all advantages and disadvantages, the balance of advantage still lies with the farm plant. He thought it somewhat misleading to refer, by inference, to the farm plants as "inadequate alternatives which will not satisfy but will impede the final plan". A study of farm plants in Alberta, made during the summer of 1944, indicated quite clearly that farmers with plants were particularly anxious to get central station power, provided the cost to them was not entirely out of line with the cost of energy from the plant.

The same study indicated that the calculable cost of energy from the farm plants may not be much, if any, higher than the cost of central station power *under average conditions*. The cost of energy from the wind plant compares quite closely with an estimated average cost for central station power. There are the disadvantages of more limited and less regular service. There appears to be a tendency for farmers to install both a wind tower and an engine. In this combination plant the wind charger is used as the main source of power, and the engine as the auxiliary. This makes for a high investment per farm, but operating costs, including overhead costs, are low per unit of energy consumed. The costs per kwh. for the combination plant compare quite favourably with the cost of central station power. There is the disadvantage of more time and care in the operation and maintenance of the plant.

Professor Stewart remarked that if all farmers connected to the lines are to be brought under uniform rates, the averaging process obscures the difference in costs of serving particular customers. But for purposes of wise decision it is essential to recognize these differences; and, in devising a programme of expansion, to consider whether there is any justification for extending the lines into areas where the additional cost per farm is necessarily relatively high. Looked at in this way, there appear to be many areas in the prairie provinces in which the individual farm plant is to be preferred.

(3) The author's position with regard to financing seemed to Professor Stewart a sound one; as far as it went.

The stockholders who put up the capital to build a plant in a competitive industry do not expect a return which will (a) yield them interest, (b) maintain the plant through a depreciation reserve; and (c) at the same time enable them to withdraw their original investment, otherwise than by the disposal of their claims over the assets of the business.

However, in regard to farm distribution lines there may be a tendency to underestimate the risk. It is easy after the preparation of an estimate of costs to lose sight of the numerous points at which the estimate is built on what are nothing better than informed guesses. In Mr. Tomlinson's type of farm electrification there may be "no margin *for* error". (second last paragraph, page 214) but there is inevitably a large error of estimate. Professor Stewart pointed out that if the community is going to insist that a programme of farm electrification be undertaken, the main question is, who is going to carry this unavoidable risk.

Professor J. W. Porteous, m.e.i.c.[2]

Professor Porteous found the paper very interesting, but one point in connection with Fig. 1, "Potential Gradient Curves", was not quite clear to him. In the case of the single grounding rod, distances are measured from the rod itself while for the triple electrode case, distances are measured from a point midway between two electrodes on the arc of a circle. He would like to see plots of the gradients in various directions near the rods. If his interpretation of the method of measurement was correct he felt that though there would still be a definite advantage for the triple electrode it would not be nearly as great as would appear from the figure.

He would support Mr. Tomlinson's plea for standardization as regards the standard size for transformers, it would obviously be uneconomical to use 5 kva. transformers if the farmer's load were going to be only 800 watts, but on the other hand it would be uneconomical to install 2 kva. transformers and then find that most farmers after realizing the usefulness of electric power would wish to build up their loads to values greater than the installed capacity.

J. W. Stafford, m.e.i.c.[3]

Mr. Stafford wished to discuss Mr. Tomlinson's paper only inasmuch as it pertains to conductors. He remarked that varying degrees of variable internal stress distribution in a composite cable are of little importance providing the degree and proportion of stress is known. Unknown quantities are the only ones which can jeopardize a particular design. Known values of stress can be and are taken care of in the recommended values of sag and tension which the manufacturer supplies with his product. Such being the case he considered that there can be no distinction between composite cables of copper and steel or aluminum and steel. So that, on the basis of internal stresses alone, it cannot be said that one cable is physically better than another.

In connection with corrosion, he thought that Mr. Tomlinson would agree that proper engineering records of the progressive effect of atmospheric corrosion on transmission lines are difficult to find. His paper infers that after twenty-five years there may

[2] Department of Electrical Engineering, University of Alberta, Edmonton.

[3] Electrical Conductor Division, Aluminum Company of Canada Limited, Toronto, Ont.

be a serious reduction in the factor of safety of steel-cored cables due to attack on the steel core. Any such progressive rate of attack on the core is almost impossible to determine without dismantling the conductor. However, records of performance of A.C.S.R. lines installed over twenty-five years have not borne out the statement. Mr. Tomlinson had referred to conductor failures in Europe but Mr. Stafford would like to mention that the corrosion problems experienced with some European aluminum cables were, following their failure, found to be due to the composition of the metal used. Some of these cables contained as much as 4 per cent. copper, and others which had been installed near Amsterdam and manufactured by Siemens-Schuckert were alloys of iron and aluminum. Since these two alloying constituents have decidedly detrimental effects on the corrosion resisting properties of aluminum alloys, it was to be expected that corrosion troubles were in some cases severe. In general the higher the purity of a metal, the greater its resistance to atmospheric corrosion. In this same respect Mr. Stafford found it interesting to note that experimental aluminum alloy conductors have been installed on the Duck Cove line of the New Brunswick Electric Power Commission, St. John, N.B., since 1929 under severe salt fog conditions and, when inspected in 1941, were found to be in excellent condition with no sign of corrosion whatsover. Canadian and American practice has been to produce the aluminum strands of A.C.S.R. from wire bars having an aluminum content of not less than 99.50 per cent. He therefore, heartily agreed with Mr. Tomlinson that the corrosion hazard had been overemphasized, but recognized that there are certain geographical areas where, due to local conditions, one conductor or type of conductor will have a better life expectancy than will its competitor.

To progress to the problem of vibration fatigue in conductors, he pointed out that the degree of remoteness in the temperature coefficient tables of two metals which go to make up a composite cable has no bearing on the endurance limit of the cable or its constituents. The endurance limit in fact is a measure of the maximum loading which a material can withstand without failure under 50,000,000 cycles of completely reversed stress. A clearer picture of the comparison between the fatigue characterictics of various conductor metals would be obtained by examining the ratios of fatigue strength to ultimate strength of the materials. This " fatigue ratio " then gives a comparison of the " durability " of the material in question; the larger the ratio, the more durable the material. Test results for steel, copper and aluminum as used in conductor material show the following values: steel — 30 per cent.; copper — 31 per cent.; aluminum — 33 per cent.

For the actual behaviour of the constituent parts of a composite cable under varying tensions, one must examine the stress-strain curves for the cable derived by test. With a homogeneous cable, this is not necessary, since all values can be obtained by simple calculation when the initial and final Young's modulus for the material is known. With a composite cable, however, there is no direct academic means of making such calculations since resistive forces due to different stranding lays and number of layers are set up, for which allowance cannot be made with any degree of accuracy. Also composite cables have a varying initial modulus which precludes any attempt at accurate calculation. Mr. Stafford did not wish to dwell upon cable calculations, but for a concise and accurate treatise upon the subject, would recommend a paper by Mr. M. E. Noyes presented before the Distribution Section of the Overhead Systems Committee of the National Electric Light Association in St. Louis, 16th February, 1931, entitled " Mechanical Behaviour of Overhead Conductors Under Change of Stress ".

He proceeded to touch briefly upon the choice of span length and in connection thereto with new developments in the conductor field. He did not entirely agree with Mr. Tomlinson's statement that the first requisite for farm line conductors is high tensile strength, the second, durability. Tensile strength is important only for obtaining the maximum *usable* span while still maintaining the limits of allowable sag. He said maximum *usable* span advisedly, because our eastern provinces, while faced with the same problem of electrifying their rural areas, are not always able to take advantage of long span construction because of right-of-way limitations. Average spans for most rural electrification installations in the province of Quebec for example probably do not exceed 250 ft. He would say, therefore, that the prime requisite for rural conductors is *low cost* based upon *usable* tensile strength. " Durability ", by which term he assumed that Mr. Tomlinson meant the degree of the ability of a conductor to withstand design conditions, must also be tempered by cost.

In connection with new aluminum alloys for electrical conductors, he found it interesting to note that two such are now in the development stage. One is a heat-treatable alloy, the other is non-heat-treatable. In comparison with A.C.S.R., C.C.S.R. and copperweld conductors, both new alloys show considerable promise as conductor material for both high and low tension lines from the standpoint of ultimate strengths, endurance limits, resistance to corrosion and last but not least, of cost,

In conclusion Mr. Stafford wished to express his thanks to Mr. Tomlinson for a very apt and able presentation of a timely subject of extreme interest to all engineers.

Gérald Molleur, M.E.I.C.[4]

Mr. Molleur would like to ask how the problem of interference with telephone lines presents itself in the prairies, and how it is solved, or intended to be solved, in view of the proposed extensive use of common grounded neutral type of distribution line at 6.9 kv.

He wished to point out that in the province of Quebec, this problem is not so much of a technical nature as of a psychological nature. Rural telephone lines there belong to small companies or co-operatives which have been operating for a good many years, and in many instances, long before any power lines were built in their area.

The maintenance on these lines had been neglected in many places, but the customers were quite satisfied with the service received. So, when a distribution line was built, with the result of interference with telephone service, the blame was laid entirely on the power company. In general it had been very difficult to convince the telephone people that the trouble was due to the poor condition of their line. In several cases, some of the power companies had willingly gone to the extent of paying part or even the full cost of

[4] Quebec Hydro-Electric Commission, Montreal.

restoring these rural telephone lines to proper condition.

These difficulties had resulted in limiting the common grounded neutral type of distribution in the province of Quebec mostly to 2.3 kv., where used at all. Mr. Molleur did not actually remember any specific cases of 6.9 kv. line of this type.

The problem is further complicated by the fact that the rural roads are relatively narrow.

F. T. Gale, m.e.i.c.[5]

Mr. Gale regretted that engineers had not explained the economic side of the rural electrification problem to the people outside of the profession. The public is quite content to leave volts and reactances to our own judgment, but when it comes to dollars and cents, that is another matter. He therefore urged the importance of explaining, to those interested, the part their dollar is to play. This task should not be left to less competent persons.

He remarked that low cost lines have been designed to deliver power to the farmer's yard, and that the following is a breakdown of the cost that would sound reasonable to the man who is putting up the money:

In Alberta, estimates and experience indicate that about $600 in material and labour is required to build the lines when the farms are three-quarters of a mile apart, which is an average in the province. He could produce material invoices, pay sheets, freight charges, etc., that are irrefutable. This $600 figure includes everything from a share of the main substation down to the meter in the farm-yard, but does not include any share of the main line and plant that might normally be charged against it.

It is the engineer's duty to point out to those concerned that this initial figure of $600 represents labour and material in the farm line alone and includes nothing for existing plant. It should also be explained how the monthly charge for service and energy is dependent upon the construction costs. The Alberta rate might be taken as an example.

The company's present monthly charge to the farmer is $5.00 net including 20 kwh., with excess energy at 2c. This might seem high but Mr. Gale believed that the following breakdown would give its justification:—

1. 2¾ per cent. for depreciation (most business men would tell us this is rock bottom—a single storm could wipe out our depreciation reserve and then we would be in the soup—) Anyway, assume 2¾ per cent. as a bottom figure on $600; this is $1.38 a month.
2. Operating charges, including such things as maintenance and ordinary repair of line and equipment, meter reading, and billing, general office and management, say aproximately $2.00 per month. We believe that this figure can be justified, but may be reduced, or even increased a few cents. (The Manitoba preliminary report estimated operating costs at $1.99).
3. Losses on energy supplied. It is now known that these losses can amount to 40 per cent. It can be shown that losses could amount to $1.00 per customer per month, basing the cost of power at approximately $25.00 per hp.-year — nearly the same price the city of Toronto pays the Ontario Hydro. Since this $1.00 per month is based on assumption and enough definite load data are not available, to be safe, 75c per month may be allowed.
4. The cost of money. Suppose money for building these lines can be obtained for 4 per cent., that is another $2.00 per month. To lower this to 3 per cent would bring the monthly cost down by only 50c.

Then we have:	Depreciation	1.38
	Operation	2.00
	Losses	.75
	Cost of capital	2.00
Or a total of		$6.13 per month.

And the cost of the 20 kwh. is not included. It is to be understood that these are general figures, but none the less close enough to indicate that any supplier of electricity cannot break even with a $5.00 monthly minimum and minimum use. How then can the farmer be supplied, as is his just right? A subsidy is suggested — but in Alberta, where the farm population is more than 75 per cent. of the total, the farmer would be paying the lion's share, taking from one pocket to put in another, and further, since the very nature of his business makes it necessary for him to sell on the open market and buy on a protected market, industry's share of the subsidy would be borne by him in increased cost of the things he buys. How much better it would be to keep the farmer in his present position of being able to pay his own way.

Mr. Gale's experience in dealing with the farmer shows that he does not want a hand out. In the Company's particular test area, the farmers were asked for a contribution of $100.00 and before asking for it its necessity was explained in much the same way as has just been roughly outlined. Every farmer was glad to put up the money. An interesting sidelight to this was that an organizational meeting was held to explain these costs a few days before the provincial election. One party's chief platform plank was to take over the power companies and to give all farmers power at no initial cost.

Without a subsidy, the alternative suggested is to give him as cheap power as it is possible to do so, and promote the use of electricity so that he can improve the quality and quantity of his produce to the extent that he not only supports the plan himself, but in doing so supplies himself with the amenities that go so far in making his place a home.

Mr. Gale again suggested that we as engineers have a duty to explain these things in addition to making our plans on economical and efficient lines.

J. W. Sanger, m.e.i.c.[6]

Mr. Sanger observed that the author had made a contribution which will be of considerable value to engineers assigned to post-war rural electrification programmes. Not unexpectedly, he had confined his paper to the electrification of farms and had presented its problems to us as a new science.

Complete farm electrification on a provincial wide basis, in an area which is predominantly grain producing, undoubtedly presents many opportunities for

[5]Engineer, Calgary Power Company Limited, Calgary, Alta.

[6]Manager, Winnipeg Hydro-Electric System, Winnipeg, Man.

the distribution engineer to do things on a scale and in a manner not attempted heretofore. However, the technical problems will not be entirely new as many of them have been the subject of a considerable amount of investigation and practical experiment in Canada and the United States during the past ten years.

Mr. Sanger thought that, in Manitoba, the most important question is the challenge to management in the matter of promoting by every means possible the highest consumption of energy for which farm income can economically be allocated. It is the extent to which this may be accomplished that will determine the starting point for the distribution engineer. There are pressing needs to get started on the job with the least possible delay. He noted that farm income is now at its peak, consequently there will be required a minimum of effort to obtain customers who are prepared to invest their money in electrical equipment and merchandise. On the other hand, all line materials and electrical appliances are in short supply and are likely to remain so until several months after the termination of the war in Europe. Altogether, farm electrification as an immediate post-war development has many uncertainties and until the situation is clarified the distribution engineer cannot make his final plans. It is for this reason that the Government of Manitoba proposes to make a test installation for 1000 farm services when the necessary equipment, merchandise and labour are available.

In Mr. Sanger's opinion there does not appear to be any good reason why the history of the growth of domestic load in Winnipeg cannot be used as a criterion of what might be accomplished in the rural parts of the province. It is true that the difference between urban and rural rates must be taken into consideration, but our present conception of standard rural rates would be radically changed if there could be any assurance of eventually obtaining public acceptance of the completely electrified rural home. The electric iron, radio, washing machine, refrigerator and water pump are expected to be standard equipment on the farm but the extent to which the electric range and water heater will be used cannot be forecast closely enough to be of any value. As these two home appliances together represent a monthly consumption of at least 500 kwh., too much weight cannot be placed on their importance in the general scheme.

The author had paid particular attention to the problem of grounding and it might be suggested that at some future time a whole paper be devoted to this subject. It is difficult for the urban engineer to reconcile himself to dispensing with the neutral conductor. His urban experience with the corrosion of ground rods and the drying out of soil under conditions of persistent fault currents makes him somewhat hesitant to approve of this practice. However, the practice should not be condemned until there is ample evidence that low resistance grounds cannot be maintained with reasonable certainty.

The author's reference to the methods of financing rural electrification projects in the past indicates something which might better be called improper accounting. The creation of capital reserves in excess of the total loss by wastage of the capital properties is nothing more than a pre-payment for which credit is received by someone at some future time. The point which Mr. Tomlinson wishes to make, and with which most people agree, is that ultra-conservatism in accounting may become a serious handicap in establishing minimum rates for service at the time when it is most necessary to promote the highest utilization of energy.

Mr. Sanger regretted that the limitation on the length of his paper did not permit Mr. Tomlinson to open up the subject of operating costs and revenue. These matters had been dealt with fully in the 1942 report of the Manitoba Electrification Enquiry Commission but there still remains plenty of room for further opinion and comment.

He felt that a discussion of the subject of the electrification of small communities and farms should begin with a clear statement of the main objective. If the objective is solely that of the profitable sale of power as a commercial enterprise, the tendency will be to serve the areas of least capital risk and exclude those which individually are commercially unattractive. On the other hand, if the objective is intended to include securing the greatest possible social and economic benefits for the area under consideration the general policy and scope of the plan would be radically changed. Uniform rates over the whole area would become almost essential and the relation between revenue and cost of supply must be placed on the widest possible collective basis. However, even under the most liberal plan, the exclusion of certain sub-marginal areas must be enforced, in which case it would seem that a reversal in policy has to be made from collective to individual consideration. In the past the problem of capital risk had been partly overcome by asking the prospective customer to pay all or part of the capital cost of extension. While this might appear to be a happy practical solution in certain individual cases, to attempt to apply it as a general policy would result in a limited coverage and subsequent disputes concerning the extent to which consumers are entitled to rebates on their capital investment in jointly used lines.

He would like to refer to the financial success of the Manitoba Power Commission which had now been operating for twenty-five years in a sparsely populated rural area. With the exception of Brandon, Portage La Prairie, Dauphin and Neepawa, the population of the towns in the area served by the Commission is in every case less than two thousand. Even under this condition of consumer scarcity, the Commission had been able to build up a completely self-sustaining system and establish uniform rates which permit all modern domestic appliances to be freely used. It is true that the Commission now receives a government subsidy of some $130,000 per annum, but if this subsidy had not been received there would still have been an operating surplus in excess of $250,000 for the year 1944.

The Manitoba Electrification Enquiry Commission recommended a rate for farm electrification similar to that which now prevails in the small communities served by the Power Commission. The question which naturally arose in the minds of those interested in the possibilities of farm electrification on a large scale is: with an investment of $700 per farm for distribution circuits is it possible to make the system self sustaining? If not, how much subsidy is required? The reply to this question may be found in the Enquiry Commission Report but Mr. Sanger would like to present it more concisely in the following manner:

In respect to customer saturation, the conditions in the farm electrification area may be assumed to vary between 60 per cent saturation and 1942 price levels (Condition A), and the most favourable condition (Condition B) which is based on 80 per cent saturation and 1939 price levels; the following indicates the approximate revenue requirements of the system.

For Conditions A and B, the system can be made self sustaining if the average annual revenue from each farm amounts to 13 per cent of the average capital cost of supplying each farm.

For Condition A, the energy consumption would require to be 330 kwh. per month, with a net monthly bill of $8.64.

For Condition B, the energy consumption would require to be 260 kwh. per month, with a net monthly bill of $7.38.

Now, let us compare the foregoing conditions with what is required under the proposed government subsidy of one-half the interest and sinking fund on the capital debt.

For Conditions A and B, the system can be made successful if the average annual revenue from each farm amounts to 7.5 per cent of the average capital cost of supplying each farm.

For Condition A, the energy consumption would require to be 120 kwh. per month, with a net monthly bill of $4.86.

For Condition B the energy consumption would require to be 90 kwh. per month, with a net monthly bill of $4.32.

All this may be condensed to the following statements:

At present-day price levels and without financial assistance from the government, the financial success of complete farm electrification in Manitoba requires extraordinary appliance sales efforts in order to attain an average monthly consumption of 330 kwh. It is difficult to see how this can be accomplished without general customer acceptance of the electric range and water heater.

With financial assistance from the government, estimated to be $2.08 per farm per month, an average monthly consumption of 120 kwh. is required. It is possible that this may be attained without a high degree of success in the sale of ranges and water heaters.

The rate schdule on which the foregoing is based is as follows:

First 50 kwh. per month......	8c per kwh.
Excess	2c " "
Prompt payment discount.....	10%

J. W. MacDonald, m.e.i.c.[7]

Mr. MacDonald thought that some general remarks dealing with rural electrification in Nova Scotia might be of interest despite the fact that such conditions as topography, climatic conditions, and the size of the farm unit differ sharply from those pertaining to the test areas dealt with in the papers under discussion.

Nova Scotia Light and Power Company and its subsidiary companies, particularly the Avon River Power Company which serves the Annapolis Valley fruit district, have been building rural extensions during the past twelve to fifteen years in the better areas adjacent to trunk lines. Following passage of the Rural Electrification Act of Nova Scotia in 1936, a programme for extending lines to more sparsely settled districts was initiated.

Before being interrupted by wartime restrictions, the extension of rural lines had reached the point where service was available to probably 60 per cent of the farms within 10 miles of the company's trunk lines through the Valley district.

There are two special types of rural area served by the company in Nova Scotia. One is the already mentioned fruit growing district popularly known as the Annapolis Valley. Farmers in this area are specialists in the production of fruit, and almost the entire farm effort is devoted to the production of one crop: apples. While the apple growing industry does produce seasonal commercial loads at apple grading, processing and packing centres, farm operations relative to the production of this crop do not tend to make this type of rural customer a user of large quantities of electric energy.

The second special area served by the company is that bordering the sea. Because Nova Scotia is almost an island with an irregular coast line this area forms a relatively large portion of the province. It is settled by farmers of a special type; farmers who recover the fruits of their labour not from the land, but from the riches of the sea.

It is important to note that, with both these special classes of rural customers, the economic significance of electric service is not nearly so great as it is with customers in mixed farming or dairy districts. The average yearly kwh. consumption is, therefore, low. In a representative group of 712 rural customers analyzed in 1942 the average yearly consumption per customer was 500 kwh. In the extension of rural lines in the territory, this low revenue per customer must be offset by higher customer density.

During the three or four years immediately preceding the outbreak of war, rural electrification made good progress on a sound economic basis throughout most of the better farming districts of the province. Provincial legislation had been passed which provided, under the Rural Electrification Act, material aid toward electrification of sparsely settled districts and, in some areas, the provincial government through its Power Commission actually undertook the construction, operation and maintenance of rural distribution systems. In districts already served by privately owned utilities, these companies build and own the distribution property. The government's subsidy scheme which is still in force permits construction of an extension if there is an average of at least six potential customers per mile, and three contracts of $2.50 monthly minimum bill are secured before building. The provincial government pays the difference between revenue received and potential revenue at five customers per mile. When the number of customers on an extension built under this so-called "Government-Aid" scheme reaches six per mile, then the extension becomes self-supporting.

The Avon River Power Company Limited built, before the outbreak of war, about 130 miles of rural line under this arrangement. Some 15 per cent of this property had become self-supporting when wartime restrictions prevented the addition of new customers. Had copper been available for house wiring, services,

[7] Nova Scotia Light and Power Company, Limited, Halifax, N.S.

etc., this percentage, it is felt, would have reached a higher figure in the ensuing two years.

Practically all rural extensions are 6900 volt grounded neutral, though a few districts are served from 2300 volt single phase extensions made from nearby town or village distribution systems.

Conductors are No. 4 A.C.S.R., or No. 6A, copper-copperweld carried on 30-ft. eastern cedar poles with an average spacing of 275 ft. Where customers are four or more spans apart, no secondary circuits are run. Instead a $1\frac{1}{2}$ kva. rural type, or if necessary a larger standard type, transformer is used at each service.

Pre-war cost of this type of construction ran around $500 to $600 per mile of bare line (no transformers services or meters). The cost of digging and setting in Nova Scotia is relatively high on account of the almost regular incidence of rock and boulders, and the particular care which must be exercised in passing over apple orchards and around the many ornamental trees which line the highways.

In considering the immediate and post-war plans for further extension of rural service, increased cost of construction is a governing factor. At present, there is an acute shortage of eastern cedar poles in the Maritimes. To permit the company's programme to get under way next spring, a thousand or more Princess pines are being cut at present; these will be creosoted and used instead of eastern cedar. A second experiment is to be carried out on a smaller scale with native spruce, the butts of which are to be treated chemically. The use of such alternatives on a major scale in the future will, of course, depend on the supply and relative cost of eastern cedar.

Every effort is being made to keep the cost of construction low, and render possible the extension of electric service to the maximum number of farms.

The development of, and results derived from, the experimental extensions dealt with in the two papers just read will be followed with a great deal of interest by utilities in Nova Scotia.

The Author

It is gratifying to those who have almost a full time job of rural electrification to know that others are taking more than a superficial interest in the subject. It is admitted that there are on the prairies some problems not applicable to all parts of Canada, and also that there exist some advantages, such as, abundant hydro power, not common to all. Further comments are invited from readers of the *Journal* so that the " happy medium " for which we are striving can be reached.

Professor Stewart's comments regarding usefulness of farm plants are correct in sparsely settled areas. That was the chief reason that, in Manitoba, the central station service area was clearly defined as early as 1941. However, it is found that farmers now equipped with lighting plants are most anxious to get central station service. Experience in Manitoba leads to belief that the farmer wants more capacity than can be economically supplied from individual plants.

In connection with grounding and potential gradients, the paper only touched on this subject. In order to clear up Professor J. W. Porteous' question regarding the potential gradient curves, it might be pointed out that the area within the dotted lines (not a true circle) is an equi-potential area, there being no potential gradient within the area. As near as it has been possible to measure, the potential gradients in various directions are as uniform as the soil in the area. A full paper on this subject would be required to show that the advantage is as shown in the graph.

Mr. J. W. Stafford's analysis of conductor fatigue is interesting and helpful. Even if aluminum has a fatigue ration of 33 per cent, slightly higher than steel or copper, the fatigue tension is much lower and can easily be reached if A.C.S.R. conductor is strung at 100 to 120 deg. F. (summer sun) and then the temperature drops to 40 deg. F. below, at which time most of the tension is transferred to the aluminum on account of its higher temperature coefficient. The author is interested to know that the manufacturer's sag charts take this condition into account. One solution is a homogeneous conductor, the other is to string composite conductors in the winter time only.

There are several comments regarding the danger of reducing first costs below the safe minimum. The main object of the paper was to stress the need of making every dollar of capital money spent go as far as possible to reduce operating expenses. Elimination of transformer primary fuses in favour of automatic reclosers at sectionalizing points may increase first costs but will reduce costly fuse replacement trips. Spending capital money where it will do the most good is where the " science " or " engineering " comes into farm electrification.

Mr. G. Molleur asks a very pertinent question regarding telephone interference. This subject was omitted from the paper because it requires a whole paper by itself. An overall solution has not been found, but experience here and in the United States indicates that length of parallel permissible with a given type of telephone circuit depends to a large extent on wave shape (harmonics). We are fortunate in Manitoba in that the majority of farm telephone lines are owned and operated by the government and are fairly high standard. Little difficulty is experienced with three phase parallels, but single phase taps have to be limited in length, or steps taken to drain off residuals and/or harmonics either from the power line or from the telephone circuit, or both.

Mr. F. T. Gale's reminder that the utility's contribution should be sold to the public is very timely and is often overlooked. The position in Manitoba is fully covered in the Manitoba Electrification Enquiry Commission report.

POST-WAR PLANS FOR RURAL ELECTRIFICATION IN ALBERTA

E. G. KELLY

Superintendent of Construction, Canadian Utilities Limited, Calgary, Ont.

An address delivered at the Fifty-Ninth Annual General Professional Meeting of The Engineering Institute of Canada, at Winnipeg, Man., on February 7th, 1945.

There is in Alberta, as in other provinces, a strong and persistent demand for central station service. Alberta is mainly an agricultural province, and the prosperity of our cities and towns depends principally on the prosperity of our farming communities. It is felt that, once the war is over and our sons return home, they will want jobs, not promises or the dole, but good creative work, work that will make this country a better place for them and the rest of us to live in. Our government has plans for the placing of many of these returned men on farms. Will these men be satisfied to stay on the farms if something is not done to make living conditions more agreeable for them? Farm electrification would help to do this.

Conditions Affecting Rural Electrification Schemes in Alberta

A general farm electrification scheme in Alberta, with our sparse population, could not be self supporting at first, and would require some outside assistance. Its object would be to build up the province by improving living conditions on the farms and providing employment for our returned men. The necessary assistance, or subsidy might be in the nature of a government grant towards construction, or a loan at low interest rates. It could be financed by holding up utility rates to the urban customers. Whatever method is used, any subsidy would eventually have to come out of the taxpayer's pocket. It is believed, however, that with simplified construction, standardized materials, economical management, by the education of the farmer in the practical use of electricity on the farm, and with an aggressive load building policy, such a subsidy could be kept low. To find how low is one of the objects of our test areas.

A farm electrification scheme, in itself, will not mean that new and larger generating stations must be built. There will be plenty of generating capacity available when the war is over; for example, if the Alberta Nitrogen Products, only one of the plants built for war purposes, were to close down, it, alone, would release enough capacity to serve 40 per cent of the farms in Alberta. While it is hoped that the general prosperity of the country will require new and larger generating stations, the production of power is not the immediate problem. The difficulty is to get the available power to the farm. It is not a question of generating cheap power. The smallest item in the total cost of furnishing electrical energy to the farmer is the cost of generating the energy. The high portion is the cost of delivering and servicing the comparatively small amount of energy required at the farm.

The first step towards a post-war farm electrification project in the province was a joint survey which has been made by Canadian Utilities Limited, the Calgary Power Company, and the University of Alberta. Eighteen areas were surveyed, each area being typical of some district so as to give as complete a picture of the province as possible. All specifications were drawn and cost estimates made by the two operating companies. The results of these surveys and the estimated costs are shown in the following table.

Summary of Eighteen Surveys

Total area surveyed	764 sq. mi.
No. of farms in area	1,451
No. of farms near proposed lines	1,033
No. of probable customers	795
Total miles of transmission line	588
Connections per mile	1.35
Miles of line per connection	.74
Total estimated cost	$457,816.00
Aver. estimated cost per connection	575.00

(All estimates based on 1942 prices and include transformers, meters and services.)

Experimental Test Areas

There are, in Alberta, some 100,000 farms. About 60 per cent of these farms are located within twelve miles of our existing medium and low voltage transmission lines. The large size of our farms and the sparse and scattered population makes it imperative, in order to make a general farm electrification scheme a possibility, to have a low capital investment per customer served. All frills must be eliminated, but, on the other hand, the lines must be as trouble-free as possible to keep operating and maintenance costs down. One advantage we have over the East is that our roads are straight, there is no rock with which to

Section 6900 volt farm lines experimental area No. 1

Transformer pole showing transformer and meter box—6900V farm lines.

contend, there are few or no trees, and ice loading conditions are not severe.

It is fairly easy to estimate construction costs, once the type of line and the area to be served are decided upon. It is far more difficult to estimate, with any degree of accuracy, the operating costs and revenue from a venture of this kind and to do this, the operating companies have installed three experimental or test areas. From these test areas, definite information and data will be obtained, covering construction costs, suitability of various materials and equipment, operating experience and operating costs. We shall be able to test various appliances as to their cost of operation and suitability for farm use. The data and information gathered from these areas will be available to all parties interested in forwarding farm electrification.

The first of these test areas is located near the village of Swalwell, some 70 miles north-east of Calgary. This is a rich dairy farming district. The area was installed by Canadian Utilities Limited, serves some 70 customers, and is now in full operation.

The second of these areas is located near the town of Olds, 60 miles north of Calgary, in a very good mixed farming district. It was installed by the Calgary Power Company and is the largest test area, serving some 110 customers. It is not yet in full operation due to the non-delivery of transformers.

The third area is located near Vegreville some 50 miles east of Edmonton. This is also a mixed farming district. This test area is partly in operation and will be completed by February 15th; it will serve some 50 customers and is being installed by Canadian Utilities Limited.

In building these two test areas at Swalwell and Vegreville, Canadian Utilities Limited have borne the full cost of carrying the electrical service right into the farm yard at no cost to the farmer; the farmer, of course, having to pay for the wiring of his buildings. In addition, the farmers must provide free right of way where necessary to install lines on their property.

The Canadian Utilities' rate schedule for these test areas is:

Monthly minimum $5.50 gross

$5.00 net which minimum includes 20 kwh.

All energy used in excess of 20 kwh.—3 cents per kwh.

It will be noted that this rate schedule has a high minimum and a low step rate. It is simple and easily understood and, while the average rate will be high to the convenience user, it is to be remembered that the investment and cost of service is just as great for the small user as it is for the farmer who makes full use of the service. On the basis of 100 kwh. per month, this schedule is comparable with the rates in force in the smaller towns and villages in western Canada.

The Calgary Power Company, in installing their test area at Olds, have used a somewhat different procedure.

Each farmer is required to put up $100.00 as a contribution towards cost of construction, the company bearing the balance. On the other hand, while maintaining the same minimum charge as Canadian Utilities Limited, they have given their customer a lower step rate of 2 cents pr kwh.

There are excellent arguments in favour of both methods. Time will tell which is the better.

In making the surveys, estimates, etc., or in the installation of the test areas, no financial assistance was received or requested by the two operating power companies from any governmental agency or department.

Construction of Lines and Equipment

The post-war scheme we have in mind is to locate small single phase unit substations along the existing lines at various points, stepping down to 6900 volts. From these substations lines would branch off in two directions using the equivalent of No. 6 copper as conductor for a distance of six to eight miles, depending on prospective load. From this main lead, we would branch up the side roads using a steel wire as conductor. Each substation would serve an area of approximately 96 sq. mi. and no farm would be a greater distance than 14 miles from the substation.

From the data gathered, we estimate that the diversified peak demand per farm customer will be 500 watts. On this basis, a 50 kva. unit substation would serve approximately 100 customers. If loads should be larger than anticipated, it would be a simple matter to change to larger units or to locate unit substations at closer intervals along the transmission line. The advantages of the small unit substations are:—it is possible to standardize as to size, spare units could be kept to a minimum, and due to their comparatively light weight, in case of damage, could easily be handled by a small crew without special apparatus. Each substation would be protected by fuse switches on the high side and single pole rural type reclosing oil circuit breakers on each main branch circuit.

The type of line we are building in these test areas is similar to that used by the Rural Electrification Administration in the States and by a number of companies in Canada, though some changes have been made to better suit our conditions. These farm lines will be single phase 6900 volts to ground. The phase wire is carried on a pin and insulator at the top of the pole, and the solidly grounded neutral on a bracket at the side of the pole. The reasons for adopting this type of construction are: its simplicity and low first cost, which is very essential in a farm electrification scheme for this province; the operating experience with this type of line has been very good; the line can readily be changed to three phase by the addition of a cross arm if the necessity should arise; the number of insulators, lightning arresters, switches, etc., is only half that required for a single phase two wire line. Only where it is necessary to carry farm lines on existing transmission line poles, or where obstructions must be cleared, will cross arms be used.

The main lead in these test areas was built with No. 2 or 4 B. & S.—A.C.S.R. and all branch leads with No. 6 B.W.G. Grade 85 solid steel. We would have preferred a three strand steel for the branch circuits but it was not available.

We have chosen 6900 as our voltage to lessen the cost of insulators, transformers, switches, etc. With the short distances and small load this voltage, however, is high enough, to permit the use of a low cost conductor without excessive drop. It will be necessary to parallel rural telephone lines at many points; with this voltage there will be no trouble due to inductive interference if the telephone lines are in reasonably good order.

Poles are 30 and 35 ft. western red cedar, Class 6 A.S.A. specifications, and all poles are butt treated. Average span lengths are 350 ft. with 30 ft. poles and 425 ft. with 35 ft. poles. It is believed that, with special high strength conductors, which are not available at present, span lengths could be increased.

All hardware is ½ in. galvanized and patent expanding anchors in two sizes are used for guying. A small anchor (3500 lbs.) is used for short runs and light strains, a heavier anchor (8000 lb.) being used on heavier strains. The use of these anchors makes a considerable saving, particularly in labour, over the standard deadman anchors.

To simplify materials, only one size guy wire is used. Patent guy fittings are used in place of strain plates and guy hooks. These make a saving in both material and labour and are neater in appearance. Guy wires are bonded to the neutral, which avoids the use of strain insulators in the guys, and through the use of metal anchors, additional grounding is provided to the system.

Our original estimates were based on using 1½ kva. transformers, but at a meeting held in Calgary last spring, in an effort to standardize rural transformers in western Canada, a 3 kva. was chosen as standard. This transformer has a single primary bushing, is equipped with a co-ordinated gap and, due to its pivot feature, simplifies mounting with attendant savings. Transformers are not individually fused on the primary side but are connected direct to the line through the use of hot taps. Overload protection is given on the secondary side only. Sectionalizing switches are used on branch taps from the main circuit. Lightning arresters are installed only where considered necessary. We believe, by omitting the primary fuse switch at each transformer, we will avoid a great deal of operating trouble through fuse replacements in bad weather.

Farm Terminals and Wiring

At each farm a service pole is set in the farm yard. On this pole a weatherproof cabinet is installed in which will be housed the meter and a no-fuse type breaker. The cabinet will be sealed but the breaker can be operated from outside the cabinet and the meter read through a lucite window. The service leads are brought down the pole using service entrance cable, Type S.E. Style " A ", 3 cond., No. 6 B. and S. After passing through the breaker and meter, the cable is carried back up the pole to a secondary rack and service is distributed to the various farm buildings. Meters with cyclometer dials are used, as they are easier for the farmer to read than the conventional dial type meter. The use of these service boxes with thermal switch will protect transformers from heavy overloads or short circuits on the farm secondaries, will prevent service calls for blown fuses and prevent farmers from plugging main fuses thereby causing interference to other customers, and will make for ease of meter reading. If a farm load should be increased, requiring greater transformer capacity, the secondary breaker can be changed at the same time. By having the meter and main switch out on the pole, theft is prevented and it makes for easier and less costly distribution to the various farm buildings.

3 kva. transformer installation—6900V farm lines.

As stated before, these are multi-grounded systems. A ¾ in. by 8 ft. galvanized ground rod was used at all transformer and service pole locations. In addition, a combination spiral and rod ground was installed along the line so that the neutral will be grounded at least every two thousand feet. It is hoped to keep the overall ground resistance to below five ohms.

Particular attention was paid to the wiring of the farms in an endeavour to get the farmer to install as adequate a system as is possible under present labour and material shortage. No conduit or metal boxes were used in barns, or where subject to ammonia fumes. All wiring systems were grounded at all points of local distribution, such as service switches, fuse cabinets, etc. This meant, in most cases at least, three grounded points on the farmer's premises. These grounds will, of course, be additional to any grounds installed by the company on its system. Local contractors do the farm wiring, and the company does not enter into any wiring contracts except in an advisory capacity. All services are three wire.

Operating Results So Far Obtained

The Swalwell test area has not been in operation long enough to give us a great deal of information as yet, but what information we have gathered to date is of interest.

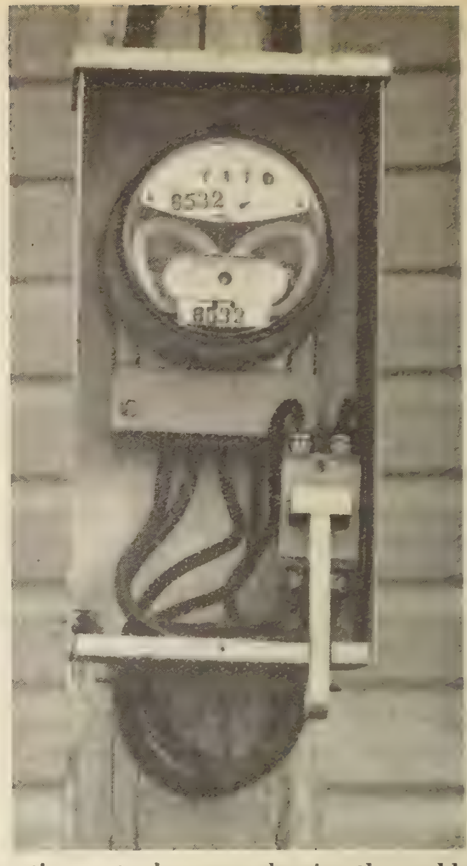
We are serving 73 customers. To serve this number of customers it took 33 miles of 6900 volt line, an average of 2.2 customers per mile; or 0.45 mile of line per customer. The total cost of the project was $33,080 or an average cost of $452 per customer. This district, as stated before, is mainly dairy farming and is better than average. In fact, from present indication, we believe that once the farmers can get all the appliances they need, it will be self-supporting. A small cheese factory located in the district will be of material assistance in doing this. Of the 56 farms connected as at January 1st 1945, which have been receiving service for a full month,

21 farms have milking machines ,
38 have some sort of electrically-driven pump
3 have feed grinders
5 have electropail water heaters.

The average kwh. consumption per farm was 117 kwh. and the average account including tax was $8.55.

We have installed, at our substation feeding this district, a graphic voltmeter, a graphic ammeter, a 15-minute interval kw. demand meter, and a watt-hour meter. With this array of meters, we will be able to get the time and extent of peaks, the total kw. demand, power factor, kva. demand and line losses of the system. We are installing demand meters on some of the farms, also sub meters on a number of appliances in an endeavour to get all information possible.

The highest kw. demand registered to date was 44.4 kw., while the highest kva. demand was 49 kva. Presuming that these demands occurred at the same time, the power factor would be 90.5.



Combination meter box open showing thermal breaker.

The average diversified peak demand per customer was 610 watts.

The voltage regulation under the present loads is very good. On a recent test, the voltage drop during the evening peak between the substation and our most remote customer was 3 per cent.

We are inaugurating a farm department and have employed an engineer, a returned man, who has been trained in agriculture, was raised on a farm, knows the farmers' problems and can talk their language. At present, we are training him in the utility business. His duties will be to call on the farmer and demonstrate what can be done with electricity on the farm, for we believe that if we wish to make farm electrification a success, we must see to it that the farmer gets full value for his electrical dollar.

DISCUSSION

Professor J. W. Porteous, m.e.i.c.[1]

Professor Porteous remarked that Mr. Kelly had given us an excellent description of the work on a rural electrification project in Alberta. In his breakdown of the cost of power to the consumer he had pointed out that the actual cost of energy is the smallest item in the total. While this is quite true, it is by no means the least important. It is definitely desirable from the consumer's point of view to use as much electrical energy as is economical and in the rates for the excess power over a certain minimum, the cost of energy is going to be a more predominant factor.

If, for example, further development of wind electric plants made available larger sizes at not too great an increase in cost, the farmer would be in the position of being able to increase his consumption at very reasonable additional cost. The battery would seem to be the limiting factor at the present time, but it is reasonable to expect that more efficient propellors and very much smaller and lighter generators will be available in the post war era.

Professor Andrew Stewart[2]

In regard to Mr. Kelly's useful paper, Professor Stewart remarks that the utilities in Alberta are to be commended for their interest and activity in connection with farm electrification; and particularly for the experimental work they have undertaken. The test areas, to which Mr. Kelly has referred, will help

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materially in advancing farm electrification in Alberta.

E. P. Muntz, M.E.I.C.[3]

As a consulting engineer, not connected with the electrical utility business, but interested as every Canadian must be in agriculture (which is our basic industry), Mr. Muntz wished to submit the following:

Obviously rural electrification on the Prairies has been retarded due to the high cost of services in thinly settled areas.

On the other hand, in parts of Canada where the density of rural population is much greater, the principal utility companies as well as the Ontario Hydro-Electric Power Commission, have been engaged upon comprehensive rural electrification programmes. Their execution has been delayed on account of the war. Nevertheless, very substantial progress has been made.

Extension of rural lines by the private utilities and the Commission is underway in Nova Scotia. In Prince Edward Island, a programme was commenced before the war to extend rural services considerably. Several hundred miles have been built in Quebec by private power companies without government assistance of any kind. The Ontario Hydro has also built at least a similar mileage in 1944; one half of the cost, however, has been assumed by the provincial government.

In British Columbia the area around Vancouver is very well supplied, though in general the service is of a suburban rather than of a truly rural nature. British Columbia appears also to be only slightly behind Ontario in percentage of customers served.

The papers just heard and the discussion following them have indicated what the Prairies are doing.

It appears then that plans are now underway in all the provinces for post-war programmes of rural electrification so that many more of our farmers very soon will commence to enjoy the advantages of low cost electricity.

The objective of all these plans must be to make available to Canadian agriculture better and cheaper electrical service than can be found anywhere else, so that electricity may make its maximum contribution to our basic industry and indirectly to the prosperity of the country at large.

Agriculture deserves and should get electrical services as soon as practicable and at the lowest possible rates.

The disadvantages incidental to providing services in the country where customers are not so far apart (i.e. more than 6 per mile) should be shared by the advantages of providing similar service in congested urban districts.

Mr. Muntz's impression was that, so far, the farmers have been given the benefit of existing transmission lines and power plants. Farm rates are bearing the cost of generating electricity and losses plus the cost of extensions only. This is a big step in the right direction.

However, in some areas, rural electrification is not closely integrated with a system serving the urban and industrial areas. It may be necessary to encourage extensions into such areas by some form of grants.

Where, as in the older provinces, electricity for all classes comes from common sources and generally through common facilities, the cost of rendering electrical services in rural areas can and should be shared equitably by industrial, commercial and domestic users in urban districts.

It should be recognized that, for both social and economic reasons, all farms within reasonable distance of an electric utility system should be able to obtain electrical services at rates and under conditions which are reasonably comparable to the rates for urban users of electricity. Every enlightened electric utility system, whether privately or publicly owned is now using its best efforts to prepare so that this most desirable objective may be attained as soon after the termination of the war as possible.

In concluding Mr. Muntz wished to note again, as shown above, that the importance of rural electrification under the auspices of both public and private ownership is well understood by the utilities from coast to coast in Canada. If his remarks have helped to clear up any misapprehension on that point, he will feel that they have been justified.

[3]Consulting Engineer, Montreal, Que.

The Author

Referring to Professor Porteous' comments, the total cost includes interest on capital investment, depreciation, transmission and distribution line operation and repairs, management, new business expenses, meter reading and billing, etc., as well as generating costs. The smallest item of these costs with the modern steam or hydro-electric plant is the cost of generating this electricity. The high portion of the cost is the cost of delivering and servicing the comparatively small amount of power required at the farm. The author agrees with Professor Porteous' statement that it is definitely desirable that the energy rates over a certain minimum be kept low if we expect the consumer to make full use of electrical service on the farm.

As the class of service furnished by wind electric plants and by central stations are not comparable, the author did not feel it was within the scope of his paper to discuss these. The wind electric plants will fill a very definite need, particularly in those portions of the province where it is not feasible to extend transmission lines. With Professor Porteous the author agrees that there is great room for improvement in wind electric plants, particularly as applies to batteries.

With reference to Mr. Molleur's remarks (p. 222), there are certain standards of construction and operation of transmission and distribution lines in all the provinces of Canada with which utilities delivering electrical energy must conform. It is also necessary that certain minimum standards be set up for the construction of telephone lines. The author believes that it will be necessary for the electrical operating companies and the telephone companies to co-operate in setting up standards of construction if rural electrification is to progress in this country. One of our test areas was built in a district where the farmers had a co-operative single wire grounded telephone system which was very poorly maintained. Before building the power system, it was carefully explained to this telephone co-operative that the building of the farm lines would create considerable interference with their telephone system. This telephone co-operative is rebuilding its system and will put it in reasonably good shape so that there should be no further difficulties. It is to be remembered that if the farmers want electrical service, it cannot be all left to the supply companies and that the farmers must co-operate.

THE ENGINEER IN ADMINISTRATION

C. R. YOUNG, M.E.I.C.

Dean of the Faculty of Applied Science and Engineering, University of Toronto
Past-President of The Engineering Institute of Canada

This paper was prepared at the request of the Institute's Committee on Industrial Relations as part of the plan of placing before the membership of the Institute matters that are related to the managerial and directional activities of the engineer.

At an accelerated rate, the employment of engineers is extending into fields that are not strictly technological in character. Time was when it was considered almost treasonable on the part of an engineering graduate to be diverted from the specialized field for which he was trained in college. That attitude has radically changed, not only to the financial and social advantage of the engineer, but to the benefit of the engineering profession itself. The influence of engineers upon the economic and social structure of the country has been definitely enhanced through their expanding participation in administrative and business activities.

The war has done much to focus public attention upon the inherent qualifications which the engineer has for managerial and directional pursuits: In its recent report, the Committee on Engineering Education After the War set up by the Society for the Promotion of Engineering Education recognizes the phenomenal increase in the use of engineering graduates in the field of management and operation of industry. There is no area of responsibility for which the engineer is better suited by temperament and training.

It has long been recognized that the engineer is definitely in a preferred panel from which directional personnel may be drawn. President Karl T. Compton, of the Massachusetts Institute of Technology, reviewing in 1939 the results of a survey of the employment of 54,000 officials connected with 500 typical industrial companies in the United States, pointed out the significant fact that a scientific or technological background notably increases the chances of employment of young men in managerial capacities. Those who have received a sound training in the principles of management and administration in college have everywhere been heavily drawn upon to fill important positions in this field.

Appreciative of the inherent qualifications of the engineering graduate for executive and administrative work in industry, and of the fact that the prizes in private enterprise are generally in positions of this type, many of the ablest young men of this continent are attracted to the engineering schools to prepare themselves for such careers.

Extent of Employment of Engineers in Administration

It is a matter of common knowledge that a large proportion of engineering graduates sooner or later find themselves in administrative or managerial positions. In its report covering the investigation of 1923-29, the Board of Investigation and Co-ordination of the Society for the Promotion of Engineering Education pointed out that while for very recent graduates about 16 per cent then found immediate employment in administrative, managerial, or sales work, when they had been five years out of college the proportion increased to 44 per cent, and when ten years out of college to 56 per cent.

A study made during the past year of the types of employment held by graduates of the Faculty of Applied Science and Engineering of the University of Toronto disclosed the fact, after making appropriate adjustments for the employment of graduates in the armed forces, that about 38 per cent of the entire graduate body is heavily engaged in administrative work and over 60 per cent are more or less concerned with it.

About a year ago the Junior Section of The Engineering Institute of Canada at Toronto conducted a survey of the nature of the employment of its members, all of whom graduated in the years 1931-42, inclusive. It was found that 50 per cent of them were engaged in administration, production, or sales work.

The experience of most, if not all, of the engineering colleges of this continent is that large proportions of their graduates occupy positions that are only slightly technological in character and may even be completely outside the technological field. Thus, approximately 50 per cent of the alumni of the Massachusetts Institute of Technology are in vocations that have no apparent correlation whatever with the specific field for which they were trained. The average level of success in this group is apparently about the same as in the technological group.

Nature of Administrative Employment of Engineers

So far as engineers are concerned, employment in industrial administration is by no means limited to the larger corporations. The oldest and best known of the engineering courses in the administrative field, that given at the Massachusetts Institute of Technology since 1915, is definitely shaped to prepare men to take positions with the smaller organizations and statistical studies indicate that the graduates in the course, which is known as Business and Engineering Administration, who rank in the highest tenth scholastically are in the medium or small-size companies by the tenth year after graduation. All of the graduates of this course in the highest tenth of the salary income have left the larger companies by the end of the eighth year after graduation. It is believed that the reason for this is that the number of administrative positions in the large companies is much smaller in proportion to the total number of men employed than would be the case in the medium or small companies where administrative, as well as executive, activities are frequently combined in a single person.

Interest of Ex-service Men in Business and Administration

Sample polls conducted by the Department of Pensions and National Health in October, 1943, indicated that more men in the Royal Canadian Air Force were interested in courses in Business Administration than in all other university courses combined. In the Navy and the Army the first choice was Commerce and Business Administration.

While many of those thus expressing themselves probably thought of a short training for comparatively junior or intermediate positions of a managerial or executive type, it would nevertheless appear that many others would wish to qualify themselves for greater responsibilities in this field. Men who on active service have witnessed the amazing effectiveness of science and technology, while themselves carrying great directional or executive responsibilities, will be particularly interested in post-war pursuits that will at the same time capitalize their respect for technology and will utilize their demonstrated capacity for management.

Relation of Administrative Employment to Professional Practice

The question is sometimes asked whether an engineer who is engaged in administrative work is actually practising engineering. As President R. E. Doherty, of the Carnegie Institute of Technology, has pointed out, one type of administration that unquestionably does constitute engineering is the management of engineering operations by an executive whose decisions rest upon professional engineering qualifications, that is decisions that a lawyer or businessman is not competent to make. In the same category should be included the management or supervision of industrial production, necessitating the passing of judgment upon the specification, design, and cost of machine tools, and upon various aspects of the production plan, such as the flow of materials and products.

On the other hand, an engineer who assumes the responsibility of directing a business or industrial enterprise at the top level is engaged in the work of general management, since such activities may be, and often are, assumed by persons with a business or legal background. Since, as yet, there is no recognized *profession* of business and industrial administration, although the emergence of one seems probable, the engineer who is employed in general management is practising a quasi-profession. It may not be engineering or a profession but it is in no sense unfitting or inappropriate.

Attitude of Industrialists

Industry very generally recognizes the value of a basic scientific training for those who would undertake executive or administrative duties in it. Nevertheless, as was pointed out by S. A. Lewishon, then vice-president of the Miami Copper Company, in his notable book " The New Leadership in Industry ", a background limited to such studies as physics, chemistry, mathematics, mechanics, metallurgy, and mining does not equip a man to act as a buffer between labour and capital. In the author's view the training given by our engineering schools does not adequately equip a man to practise so-called " human engineering ". Industrialists have often found that the men who come from such schools are excellently prepared in technical subjects . . . in matters having to do with inanimate things . . . but woefully unprepared in the art of developing the human beings under them. During the last war a Mediation Commission, set up to investigate industrial unrest in communities of the western United States, reported to the President that:

" The managers fail to understand and reach the mind and heart of labour because they have not the aptitude or the training . . . for wise dealing with the problems of industrial relationship."

The managers in this case were mostly engineers. Pursuing the matter further, Mr. Lewisohn remarks:

" Indeed, it appears that the training of the engineer solely in the reactions of dead matter, has tended to cripple his native capacity in handling human relations. A narrow technical education limited to the quantitative sciences does not help a man to assume the leadership of men. We have not yet come to the point in our social sciences where human reactions can be weighed or measured. Such a training retards the development of imaginative understanding so vital in human leadership."

Writing in the *Journal of Engineering Education* for November 1944, Mr. E. G. Bailey, chairman of the Bailey Meter Company, and vice-president of the Babcock and Wilcox Company, has this to say of the shortcomings of traditional university training of engineers for those who would engage in managerial pursuits:

" Many engineers have filled high executive positions very creditably, but the trend seems to have been that the great majority became so restricted to specialized engineering problems that they failed to grasp and advance in the fields of human leadership, judicial balance and economic concepts that are so necessary in industry to-day and will be even more so in the years to come. . . .

" The executive is supposed to grow or sprout out of the graduates of the engineering school or even from the ranks of the technician by some magic. The fact that more do not do so leads many to realize that there is something lacking in our engineering curricula of to-day. We find many lawyers, accountants, and men with general business education stepping into executive positions of corporations doing a strictly engineering line of business. Is there something gained by these professions, either in school or later experience, that gives them abilities which the engineer has not attained or has not had a chance to gain from our present curricula or training? "

Provision of Administrative Training in Educational Institutions

There is a growing realization of the need for the giving of special attention to appropriate background training in the engineering colleges for managerial and administrative pursuits. In its recent report, the Committee on Engineering Education After the War of the Society for the Promotion of Engineering Education pointed out that one of the three important trends in engineering education is that leading to the preparation of men for careers in the operation and management of industry. Developments therein make opportune an increased attention to the production of industrial materials and of consumer goods and to the recruitment of the production personnel as distinct from research and planning personnel.

A thoughtful and independent observer, Professor H. J. Gilkey, of Iowa State College, points out that " from the field of design and construction the engineer is being urged and vitally forced into the fields of finance, management, economics, and politics ".

Stimulated very largely by the pronounced success of the course in Business and Engineering Administration, established twenty-nine years ago at the Massachusetts Institute of Technology, nineteen American engineering colleges offer fully accredited courses in fields pertaining to engineering administration, administrative engineering, management engineering, or industrial engineering. The reception of the graduates of these courses has in general been excellent, and it is the belief of the institutions offering them that demand for men trained according to the programmes mentioned will increase after the war.

Adopting an attitude that characterized the critics in the first years of the engineering colleges, when the wisdom of formal engineering education was being questioned, some persons have expressed doubts concerning the ability of any educational institution to teach the fundamentals of administration. The conservative English publication *Nature* takes issue with them in these words:

> " We may indeed hope that further attention to the training of the administrator and manager, as part of our programme of educational reform will explode the superstition that business and administration cannot be taught in a university, and demonstrate that a university can provide those whose profession is to be industry or business with a three-year discipline in the fundamentals of the problems they will meet in their professional career. Thus we may ultimately provide both industry and Government Departments alike with administrators having sufficient scientific background to appreciate the scientific factors in the problems confronting them. . . ."

Administrative Successes Enhance the Professional Status

One of the reasons for the tardy recognition of engineering as a learned profession has been that engineers have only too seldom been brought into competition with men of other professions and callings on the same stage and under conditions in which the occupational factor does not count. So far, the engineer has sought to be judged on the basis of his performance within the rigid bounds of his own technological attainments. The moment he enters the field of management or administration, however, and becomes a contender with lawyers, or doctors, or men of business, he is presented with an opportunity of showing his ability to hold his own with the best of them. In many cases his habits of mind, his approach, his method, and his personal characteristics will reveal his superiority. Public recognition will follow, and with it a general enhancement of the status of the profession to which he belongs.

One cannot set aside the blunt realism of Sir Hugh Dowding, a famous chief of Fighter Command, in his observation on one of his officers who was relying for advancement on the excellence of his technical qualifications:

> " This officer is a highly qualified engineer, a fact which has been a hindrance rather than a help to him throughout the whole of his service."

There should be frank realization of the fact that assignment to high responsibilities in non-technical spheres will come largely through demonstrated superiority in fields that have been traditionally regarded as the territory of others than engineers.

BRITISH ENGINEERING EDUCATION AND TRAINING

A. P. M. FLEMING, C.B.E., D.ENG., M.I.E.E., M.I.MECH.E.
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In every phase of engineering, British practice for a century past has achieved world-wide renown. The high quality of British workmanship has been notable, and in the field of technical progress and invention, British engineers and scientists have been in the forefront. These two features — fine quality of workmanship and technical excellence — are fundamental features in the British methods of educating and training engineers, and it has become generally recognized throughout the engineering and manufacturing organizations that suitable training comprises a period of technical education in applied science, together with a period of practical experience in industry. Indeed it is now traditional in British engineering that practical experience should be an outstanding feature of a young engineer's training. This is in marked distinction to some foreign methods of training.

At the beginning of this century, the view was held by many prominent engineers that the appropriate training for an engineer was to proceed into a works at the earliest school-leaving age to work as an apprentice learning an engineering trade, and in the evenings to attend technical classes for which widespread facilities were provided throughout the industrial parts of the country. Gradually and with the passing on of the older type of industrialist, this view changed, and increasingly more attention was paid to the technical side of an engineer's training. Men who had taken degree courses in the engineering faculties of the universities were absorbed into industry and appropriate short courses of practical experience provided for them.

To-day the engineering profession is extremely democratic in that, in comparison with most other professions, there are several alternative ways of acquiring professional status. For instance, a boy may leave the elementary school at the school-leaving age and commence a trade apprenticeship training which will continue to the age of 21 years. The able and ambitious boy on such an apprenticeship may, by evening study and in some cases supplementary part-time day release by the employer, pursue courses of technical instruction which will lead him through the successive stages of the National Certificate Courses in Engineering to a high technical level, and in the meantime he will have acquired a very complete practical training and experience. Alternatively, he may extend his period of general education in the secondary or public school until he has acquired such a standard as will enable him to proceed, if he so desires, to a university. Should he at this stage go into a works instead, he can, in the larger organizations, follow a special apprenticeship, usually of about four years' duration, during which — again by part-time day or evening technical courses — he can equip himself for professional engineering. If, having qualified for entrance, he decides to go to the university, on the completion of the course and having obtained a degree, he goes into a works for a period of practical training of two years' duration. There are still other alternatives; he may, for instance, enter a works for one year before going to the university and do a second year of practical training after he had obtained his degree. In some schemes there is rather more intimate sandwiching of the technical and practical periods of training. It will be observed, however, that in all these methods, practical experience still claims a prominent part of the total time spent in training.

With regard to the technical side of an engineer's training, this may be obtained either at a university or full-time day technical college, or by part-time study. The student who has attained a satisfactory level of general education at the age of, say, 18 to 19, may proceed to an applied science faculty of the university, with or without a preliminary short period of training in works, which would not normally be of more than one year's duration. At the university he spends from three to four years in study which comprises a knowledge of the fundamental sciences underlying engineering and the application of these sciences in practice. After graduation he may continue with a post-graduate course leading to a higher degree, or he may proceed into industry to obtain practical experience over a period of not less than two years.

Alternatively, having reached a satisfactory level of general education, instead of proceeding to the university he may enter works and spend a period of not less than four years in practical training as an apprentice, and during this period — by part-time day or evening study — he can take advantage of the many facilities available to acquire a really sound technical education through well-organized courses leading to the Higher National Certificate set up jointly by the Board of Education and the professional engineering institutions.

Or again, on leaving the elementary or junior technical school, he may enter industry as a trade apprentice, and by a longer period of part-time study ultimately proceed through the National Certificate Courses and attain a satisfactory technical qualification.

The practical training, except in the case of the boy who enters a works from the elementary school or from the junior technical school and who is primarily interested in learning an engineering trade, is of a special character. It is recognized that the young man whose general education is up to university entrance level is suitable for training for the technical staff positions in the industry, and the practical training provided for him is designed to give a wide engineering experience in the various phases of manufacture, — works production, drawing office, testing, inspection, and other aspects of manufacture, and in some cases, research, engineering design, and commercial work. It is sufficient to enable such a student to determine for himself the eventual branch of engineering employment for which he feels himself best fitted. Similarly, for the more fully technically-equipped trainee from the university the practical course is designed for the same purpose but occupies about half the time.

At the end of the combined course of practical and technical preparation, the trainee may take up a junior position in the organization manufacturing engineering plant and apparatus, or, alternatively, in operational work, consulting practice, or maybe teaching. Whatever sphere he chooses, in a profession so essentially technical in character it is very necessary for him to maintain contact with technical developments, and this means the study of current technical literature, the proceedings of the engineering professional institutions, and in some cases attending special part-time advanced technical courses. In the large engineering organizations advanced courses are provided for the young engineer who has had some initial experience in one or other of the main broad divisions — works' management, design, research, and selling. By such means the able and ambitious trainee can be provided over a period of years with a range of practical experience which will equip him for promotion to the higher executive ranks of his profession.

The professional status of the young engineer is achieved when he secures entry to his professional institution — the Institution of Electrical Engineers, the Institution of Mechanical Engineers, or the Institution of Civil Engineers. The entrance requirements demand a background of practical training and experience, and technical qualifications obtained either through the university or part-time technical college courses already referred to, or by the Institution's own examination. The conditions of admission are established under the guidance of experienced engineers, and the standards maintained in accordance with progress in engineering science.

In the future the position may be altered by the raising of the school-leaving age and by the provision of part-time day continuation education up to the age of 18 years. These educational reforms will provide a broader foundation for those who wish to prepare for a professional career, as distinct from those who desire to become artisan workers. The increasing national interest in technical education will lead to the setting up of more widespread facilities for technical study and to more advanced courses. The growing developments in research open up new possibilities for engineers who have had suitable training in physics and have the interest and capacity to pursue a research career.

CANADIAN ENGINEERS' PART IN THE WAR

GENERAL THE HONOURABLE A. G. L. McNAUGHTON, C.B., C.M.G., D.S.O., M.E.I.C.
Minister of National Defence, Ottawa

Address delivered before the Montreal Branch of The Engineering Institute of Canada at the Mount Royal Hotel, Montreal, on Thursday, February 22nd, 1945

Mr. Chairman, Past-Presidents of the Institute, Ladies and Gentlemen:

Both my wife and I count it a very happy privilege to be with you here tonight; and I deeply appreciate the opportunity which you have given me to speak to you briefly on this occasion.

It is now something more than three years since last I came before a gathering of The Engineering Institute of Canada to carry to you, and through you to the members of our profession throughout the Dominion a message and an appeal—a deeply serious appeal indeed for the circumstances which then conditioned our lives and compassed in our future were very grave—grave and dangerous, almost beyond the mind of man to conceive and understand.

At that time the Canadian Forces overseas had grown to a Corps and every effort was being concentrated on the great task which lay ahead. Day by day, new convoys came to us across the North Atlantic bringing to us additions to our strength as fast as ships could be found and made available to transport the men and the supplies we needed most.

The anxious days of the battle of Britain were then past. Through these for more than two long years we had stood on guard in that ancient citadel of freedom against the ever present menace from across the narrow waters of the English Channel where the Nazi hordes were mustered in all their might in France and Belgium and Holland and northward to Denmark and along the Scandinavian coast.

By then we could feel that Britain was a bridgehead reasonably secure in which the vast potential forces of the North American continent could be assembled. We could lift our eyes from the immediate pressing problem of defence and contemplate again the time when we might strike back in the continent of Europe itself—when we could meet the enemy there again in open battle and seek a decision which would bring about his final defeat and give us peace once more. We could lift our eyes and give our thoughts to the plans and preparations that needed to be made. We could think out what we should do in order to make the best use of all the great abundant advantages we had—or could have, if we had the wit to turn them to account.

And what were these great advantages which gave us faith and promise for the future?

Our Resources for Warfare

A great band of young Canadians highly educated and naturally familiar with mechanism in all its varied forms—intelligent, resourceful, full of initiative and responsive to leadership.

A great home country in active process of bringing its vast natural resources into use and engineers skilled in the art and accustomed to the conduct of projects of the greatest magnitude.

A mass production industry of great variety, flexible and most comprehensive which could take a new prototype or design and rapidly turn it out in any numbers needed and with the high precision that is required in the weapons and apparatus of modern war.

We had industrial leaders of vision and resource and experience trained in the hard school of a pioneer country. Many of them had been abroad before the war and knew the problems which we faced. To them the science of war production was no black art or mystery and they had no inferiority complex to deter them from undertaking something new and different.

Raw materials in abundance were to be found for the looking. We had a background knowledge of science in our universities, and wide experience in engineering and in research and in development of many kinds; and in all a people willing to devote their labours without stint to the great cause we all must serve.

Requirements for the Attack

What we needed for the European attack was the most highly mechanized army which could be created, equipped and trained in the limited time available before this great endeavour could be launched. Certainly a year was available, more probably two. We needed armour and engines for employment in the field. We needed new and better mechanical vehicles to give us facility for rapid movement and to transport great masses of equipment over great distances. We needed new and better weapons of greater power and range and more precision in the accuracy with which they could be directed on the vital points within the enemy's dispositions. We needed new and better propellents for our guns. We needed new explosives of more intense character to shatter the enemy's fixed defences of concrete and steel and to penetrate the heavy armour of his tanks and other fighting vehicles. We needed better cameras and optical equipment to detect and locate his works for defence and offence, and overcome his camouflage. We needed better gear to tack his aircraft and bring effective gunfire against them in the few split seconds that they might be engaged. We needed docks and wharves to turn an open beach into a port and bridges to cross the many large rivers that lay across the path of invasion into Germany. We needed landing craft and amphibious vehicles to facilitate the landing and the negotiation of streams and swamps and other water obstacles. We needed to ceaselessly experiment with all this new gear to work out and evolve the form of organization and the methods which could best be used.

We could spend material in the most generous profusion to bring about the enemy's defeat and it was right to do so to save the precious lives entrusted to our care.

Much of this great work of experiment and development had gone on in the Canadian Army as opportunities were made throughout the period of the battle of Britain. There had been the closest co-operation with the various British authorities and, with their encouragement, progress of considerable value had been achieved in many lines which we had undertaken as our share in the general effort.

This was the reason for which I came back to visit

Canada in January 1942, and it was the reason for the appeal I made to this Institute at your annual meeting on February 6th in that year.

To-night I have the opportunity to tell you something of what has since been accomplished by our engineers and scientists, by our business men, by departments of the Government, by the executives and organizers, by Canadian labour and by all who rallied to the call and bent their minds and efforts to give our army and the armies of our Allies the tools of war that were required from Canada.

Remarkably Effective Contribution

A year ago the conduct of our army overseas passed from my hands to others and I returned to Canada. For some months I had the opportunity of moving about to visit the research and other establishments which had been set up and to see something of the developments which had been made or were in process. Later I was again called back to the Ministry of Defence, where once again these matters come to me day by day so that I may know what is being done. So I think that I can speak with some measure of authority on the results which have been gained and from that intimate knowledge I say to you: the engineering profession in Canada, and your associates in scientific research and development have made a most remarkable effective contribution in manufacturing and in other related sphere to our army which landed in Normandy last summer on D-day and which is now with others so gallantly engaged along the Rhine in what may well turn out to be a part of the opening phase of the decisive operations for the final defeat of Germany. You have made as well great contributions to our First Canadian Corps in Italy. Great contributions have also gone to the British armies everywhere. To the forces of India and of Australia and of the other Dominions. To the United States in fair return for the many great new inventions and devices they have contributed to us.

Some of the Accomplishments

The catalogue of the things done in Canada which are of outstanding importance and significance is very long indeed but security still bars anything but the most general reference.

There is all that has been done in *radar* to give delicate precise gear to track the enemy's aircraft and his ships at sea; to direct our guns on land, in the coastal forts, and on our ships against these targets. We had an early start in this for, in 1938, when the National Research Council was asked from Britain to take up this task, we found we already had a strong nucleus of well-skilled workers who had been engaged in studies of the ionosphere and of the cathode ray compass. Canadian designed and built radar sets have gone in great numbers to every fighting service and to every ally in our cause.

There is our optical industry built around a small nucleus which was also in existence within the National Research Council before the war. Our binoculars, dial sights, prism periscopes, etc., are of the highest quality and everywhere most sought after.

There are shells for medium guns designed by Canadians with greatly increased range—more than two-fold greater explosive and a lessened total weight such that five of the new and better shells can be carried in place of only four of the older poorer type.

There are long-burning time fuses of remarkable accuracy for ranging and other use. These fuses were first made here in Canada and the wonderful high precision they showed was a very welcome surprise to all.

There is the Canadian method of doing air-burst ranging which is now the standardized procedure for the whole British Army. The range tables and the charts and the intricate difficult calculations on which they were based were done by young Canadians who rank high in the science of ballistics.

There are the new Canadian armour-piercing shells which have given the British anti-tank guns the extra margin of performance to penetrate the new heavily armoured German tanks and self-propelled guns. For this, tungsten was required which formerly came only in limited quantities from China and Portugal and a few other places. Our Mines Branch was asked to find tungsten in Canada. In the summer of 1942 they covered the country with prospectors. They quickly found and reported deposits running in one case alone into several hundred thousand tons which could be economically worked. We will have the benefit of this long after the war has ceased and we can use the carbide to tip our lathe tools and face our gauges.

There are new explosives and propellents which first took form in Canadian university laboratories and new methods of making others of higher power which have opened their use to give greatly increased effect from aircraft bombs.

There are new methods for rapid construction of airfields which have found their place in the assault from north-west Europe to far-away Burma. These were first developed in England by Canadian engineers—members of this Institute—in association with technical experts from the Canadian oil industry.

There are new methods for mining and for clearing minefields invented and perfected by Canadian engineers and the Canadian Armoured Corps. Some of these have found another use in the United States technique for clearing out the Japanese in the Pacific.

There are the outstanding contributions made by the Canadian medical profession for the care and welfare of our men in the field and in the treatment and cure of those who become sick or wounded. Better clothing, better shelter, remedies for seasickness and countless other aids and preventatives of one dread ailment or another.

There is the Canadian process for the extraction of metallic magnesium, the lightest structural material known to industry. It gives a product of such purity that corrosion is no longer a bar and the costs are down to a point that the uses in the arts are widening both for war and for peace.

There are our Canadian radio signal sets of varied types, in which remarkable increases in efficiency have been obtained. Equally remarkable has been the Canadian simplifications in design and operation. These wonderful new sets have gone not only to our own and the British Army but we have contributed also substantial numbers to Russia.

Not the least part of the Canadian contribution has been the perfection in packaging to ensure the safe arrival of all sorts of gear complete in every component which, after it leaves our ports and is transported by ship half round the world, may find its way up the Burma road or across the Himalayas by air into China or elsewhere into some far desert or jungle or other place, there to be assembled and perhaps be put immediately into action against an enemy. The constant thought for the " user " and the care for his convenience and interest which has marked our Canadian war industry is, I think, something of which we all may be very proud. In these things it is the little details that count.

There are our Canadian contributions to defence in chemical war which are ready should this method be used by the enemy. There are our developments of new chemical warfare materials as a deterrent to warn off the German from any such thought. There are our contributions to smoke and to flame which were worked out by Canadian engineers in collaboration with the Petrol Warfare Department in England and perfected here in Canada and in the United States.

Automatic sights for coast defence—new machine carbines—new rifles—new pistols, new mortars—new guns—new forms of bridging—new motor vehicles of very many types for many varied uses.

Mass Production Has Been Achieved

And these things of which I speak are not mere samples or prototypes of experiment and test, for they have now been manufactured in immense quantities, and flow out from our factories here across the world wherever they are required for military operations.

On the second day I was at the Ministry of National Defence, I was told that, ex officio, I was a member of a certain Board, and I was told that I should join a meeting then in progress of which I had not previously heard. I went there with some reluctance as an extra unwelcome task, only to find that the first five items on the agenda were requests from Britain for things which we had proposed in the Canadian Army before I left the United Kingdom as projects for development and which had since been carried to completion by our own officers here in Canada; which had then been tested by the War Office and found to be so satisfactory and to represent such substantial improvements that they wished to introduce them into the services forthwith.

The demands were for quantities measured by scores of millions of dollars and I was almost reconciled to my new duties as a Minister to find that I had a part in seeing to it that authority for production was given very promptly.

There is much else of which I may not yet speak. The list of these developments made by young Canadian engineers and scientists is very, very long and there is romance and achievement in every line. I hope a full account will be published some day when the war is over so that you all may know the names of your fellow members whose brain children are these marvellous contributions to our war effort.

In Conclusion

I end now, and I thank you once again for the pleasure you have given my wife and myself in having us with you to-night and for the privilege I have had of bearing tribute to the work of the Canadian engineers in and for our army.

For that army I say "Thank you" to all of you who have worked so hard to give us the newer and the better weapons and equipment so that our men might outmatch the enemy on the field of battle.

That army of ours is equipped with the best there is, it has been denied nothing that is required, it is properly reinforced to carry through our just part in the battles still ahead, it is highly trained and skilled in all the arts of war, there is youth in the ranks and youth in command, it is under wise determined leaders, it will be fully maintained until victory is achieved.

And so, we go forward into the future with every confidence in the ultimate result.

NOTICE TO STUDENTS

Student members of the Institute who are about to leave the university, whether definitely or only for the summer season, are requested to inform Headquarters of their new address, so that the *Journal* may be forwarded to them.

This is particularly important in the case of those who live in fraternities or boarding houses during the scholastic year. With present restrictions on the use of paper, it is imperative that no copies of the *Journal* go to waste.

Don't forget to inform us of your new address when returning to college in the Fall. Headquarters will change your mailing address as often as necessary provided you supply the information.

All changes should be recorded with the General Secretary, 2050 Mansfield St., Montreal 2.

From Month to Month

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

A REHABILITATION SERVICE TO MEMBERS

For almost two years officers of the Institute have been hoping to establish a real employment service for members being discharged from the active service forces. From the original conception of the idea, through surveys, consultations and committee meetings, the project has developed to the point where funds are now available and a suitable director has been selected.

The new director of rehabilitation and personnel services is Major Donald C. MacCallum recently discharged from the army because of wounds. Major MacCallum received his early education in Montreal at Lower Canada College and Westmount High School, entering McGill on a C.P.R. scholarship and graduating in mechanical engineering in 1938.

At McGill he was president of the Engineering Undergraduate Society, permanent president of his class, a member of the Students' Executive Council, the Scarlet Key Society, the Martlet Society and the honorary society Phi Epsilon Alpha.


Major-Gen. Howard Kennedy, M.E.I.C.

During vacations and after graduation he was employed by the C.P.R. Angus Shops, the Consolidated Mining and Smelting Co. at Trail, B.C., and the Canadian Ingersoll Rand Co. at Sherbrooke.

In July 1940 he enlisted with the 27th Canadian Armoured Regiment (Sherbrooke Fusilirs) and served as lieutenant and captain for three years, in Canada, Newfoundland and England. After a short experience in Africa he transferred to the 12th Canadian Armoured Regiment (Three Rivers) as captain and major in Italy when he was wounded by shell fire in June 1944, at Lake Trasimeno near Florence. He was hospitalized in Italy, England and Canada being discharged in Montreal on March 14, 1945.

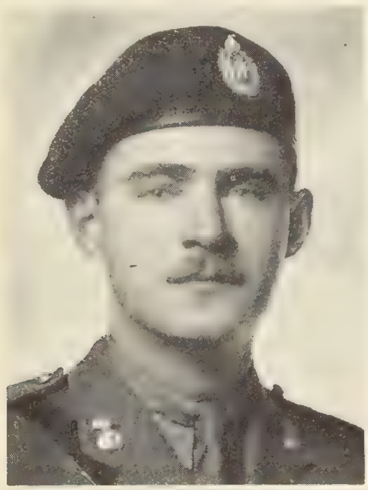
Major MacCallum is excellently fitted to his new work both by experience and disposition. With the support of the advisory committee upon which Major General Howard Kennedy acts as chairman it is expected an excellent service will be established. Already many completed questionnaires have been received and a study of each individual case is underway.

Under authority of Council a letter was sent in March to all members in the services, informing them of the Institute's interest in their post-war occupations, and inviting them to make use of the service. The letter reads as follows:

The officers of The Engineering Institute of Canada are deeply interested in the rehabilitation of members who are serving in the armed forces. They would like to secure now certain information that will indicate the best means by which assistance can be rendered to those who may desire it, upon their return to civil life.

The members of the Institute at home are proud of their fellow members who, to the number of more than a thousand, have dedicated themselves to the national cause and have brought great honour and distinction to the profession. They will be happy to lend a hand to those who may wish it.

If you think the Institute can be of assistance to you, please give us the information called for on the accompanying form. Any additional details that you think would be helpful will be appreciated. Perhaps there is something the Institute can do that is not related solely to your demobilization. If so, tell us about it.


Major Donald C. MacCallum, M.E.I.C.

The membership is now about 7,000, reaching into every corner in Canada. Such an organization should be a great potential for service to the man in uniform. Tell us what you would like to do and every effort will be made to do it.

In order to do the best job possible, Council has set up a special committee, under the chairmanship of Major-General Howard Kennedy, M.E.I.C., representative of the three services and of industry, which will have charge of the activity. The full time services of another member of the Institute are being secured to be devoted entirely to this undertaking.

We realize that our mailing list may not be up-to-date in every detail. Therefore, if you know of any member in uniform who has not received a letter similar to this, we would be glad to have his name and address, or to have you inform him of our interest.

Please remember that the Institute is yours. You have the right to expect assistance from it. You may be certain that a sincere effort will be made to meet your demands.

We join with all members of the Institute and with all Canadians in wishing you the best of luck and quick return to your home.

Yours sincerely,

E. P. Fetherstonhaugh,
President.

L. Austin Wright,
General Secretary.

COLLECTIVE BARGAINING

The recent decision of the Wartime Labour Relations Board (National) relative to an application from certain non-professional employees of the Bell Telephone Company has been taken by some engineers as establishing a precedent that affects the principles of collective bargaining in relation to the profession. A perusal of the official decision does not seem to reveal any reference to engineers.

In the first place the employees of the telephone company did not include engineers in the group for which they were asking accrediting. A letter from the Chief Executive Officer of the Board to the Institute says: " In answer to your question, I would state that the applicants did not request the inclusion of engineers in the bargaining unit for which certification was sought " and " In view of the foregoing, it is obvious that it was neither the intention of the applicants nor of the Board that engineers be included ".

In the light of these statements it is difficult to see how the ruling can serve as a precedent for recognition of any engineers' bargaining agency already formed or to be formed. All it does is recognize the bargaining unit for certain telephone company non-professional employees.

The failure of the group to ask for the inclusion of engineers may be significant but it does not seem reasonable to state that because of this omission, some other bargaining agency has been recognized as representing engineers.

In all likelihood the " federations " in Ontario and Quebec will be recognized by the Board when they apply for accrediting. In fact any agency that can prove that any appropriate group of engineers has selected it as its representative will probably be accredited. That is the spirit of the order-in-council, a fact that seems to have been overlooked by many.

No agency will be accredited unless it can prove that it has been properly chosen by the workers concerned, and then only to represent those particular workers. Every new group of workers will require a separate application to the Board for the accrediting of its chosen agency. There will be no blanket rulings. The employees decide who shall bargain for them, and they may select an outside agency such as a trade union, or a " federation ", or they may choose one or more of their own fellow-workers. Up to now the leaning as disclosed in discussions seems to be toward the latter procedure, but so far as can be seen no group of engineers has yet named to the Board any bargaining agency.

The Minister of Labour's recent ruling that professional workers shall come under order 1003 for a period of six months, so that they may acquire collective bargaining experience, will mean nothing if during that time no engineers organize themselves, apply for accrediting and undertake bargaining negotiations with their employers. Six months is not very long for a matter of this kind, and it well may pass without any action being completed.

The Minister's stand that the professional worker must have collective bargaining experience before his case is decided, is not unlike a municipality telling a man who is building a house in a new section of the town that they cannot tell him what they will do in the event of a fire until he actually has a fire. Surely the experience of others and the particular needs of the case will govern. Why can't a constructive decision be made on that basis?

COURSES FOR PRACTISING ENGINEERS

Recently there has been a noticeable development in Canada to make available to practising engineers, short courses of instruction on the subject of Soil Mechanics. The *Journal* has been informed of such courses already completed at the Universities of Alberta and Saskatchewan, and more recently of one to be given at Toronto. Another course is now underway under the auspices of the Junior Section of the Montreal Branch, with the Ecole Polytechnique furnishing the laboratories.

The Toronto course runs from May 14th to 18th and is being given by the Department of Civil Engineering. It will consist of a series of illustrated Lecture-Demonstrations. Two sessions will be held each day, in the mornings from 10 a.m. to noon, and in the afternoons from 2.00 p.m. to 4.00 p.m. Summaries of each lecture will be provided. Facilities may be made available for those who so desire to perform laboratory tests themselves, possibly on one or two evenings. An informal dinner will be held at the conclusion of the course.

Probable Arrangement of Subjects

Monday	14th May—a.m.	*Introductory Addresses. The History of Soil Studies.
	—p.m.	*Surface Geology of Eastern Canada.
Tuesday	15th May—a.m.	Soil Classification.
	—p.m.	Water and soil.
Wednesday	16th May—a.m.	Compaction of Soil; Stabilized Soils.
	—p.m.	Groundwater and Underground Flow.
Thursday	17th May—a.m.	Shear Strength of Soils. Stability of Banks.
	—p.m.	Bearing Capacity; Load Tests Consolidation and Settlement.
Friday	18th May—a.m.	Soil Sampling; Indicator Tests.
	—p.m.	Some Achievements of Soil Mechanics. (Evening) Informal Dinner.

All lectures, other than those marked thus*, will be given by Robert F. Legget, Associate Professor of Civil Engineering, University of Toronto.

Registration

Application for enrolment in the course is to be made on the enclosed registration form which should be returned promptly to The Director, Department of University Extension, University of Toronto, Toronto 5, Ontario. No applications can be accepted after April 30th.

A registration fee of $10.00 will be charged for the course. This fee will cover the entire course, and includes also the cost of the informal dinner. Remittances must accompany applications.

Final details will be mailed to all those enrolled in the course on or about May 1st.

WARTIME BUREAU OF TECHNICAL PERSONNEL

Monthly Bulletin

Science Student's Regulations

The visits to Canadian universities, referred to in the previous month's report, were completed during the month of February, making it possible to make a complete report covering all the twenty-three institutions involved. A total of 1,282 graduating students were interviewed individually by representatives of the Bureau and of these 815 were referred to representatives of the technical branches of the Navy or Army or both to be considered for technical appointments. The great majority of the 467 who were not found eligible for reference to the Armed Forces were in too low a medical category to meet the requirements for reinforcement officers. A few had already served and received their discharge and a limited number were disqualified because of the fact that technically they are considered of enemy alien origin. This latter technicality applies to students who are refugees from European countries; but it should be pointed out that there was no sign among these men of any lack of sympathy with the Allied cause.

In connection with the desire of the Department of National Defence to secure from among graduating science students a certain number of candidates who might be selected for training as infantry reinforcement officers, 478 of those in suitable medical category expressed interest in such an opportunity of seeing service in the Armed Forces. These men are all needed for essential technical activities, but the need for potential infantry officers is most important. Therefore, it is felt to be proper that the Department of National Defence should be given every facility to consider for infantry officer training such of these men as are not selected for technical appointments.

It was found at the expiration of the period allowed by public notice for recording needs of essential civilian undertakings that slightly over one thousand openings existed for employment of this year's science graduates. It is obvious, therefore, that the experience of previous years will be repeated in 1945 in that the supply of newly graduated technical personnel will not be equal to the current demand.

In co-operation with the Employment Service and Unemployment Insurance Branch of the Department and with the university authorities, the necessary steps were taken to provide permits for useful summer employment for undergraduates in science and engineering. In this connection, the Bureau made available at the universities a comprehensive list of such openings, which will be followed by a supplementary list at a later date.

Supply and Demand

As an indication of the continued need for high output of artillery ammunition, an announcement of the Minister of Munitions and Supply drew attention to the fact that severe restrictions in the use of steel had to be continued. In order to maintain both quality and quantity of production, the various explosives and ammunition plants concerned have had to keep their engineering and scientific staffs at full strength. This situation has also resulted in a continued need for inspecting officers on the staff of the Inspection Board of the United Kingdom and Canada.

Other typical industries which have been under continued or renewed pressure due to war production needs, and which normally use considerable numbers of technical persons, are those involved in the production of tires and aluminum.

The recorded needs for technical persons in civilian undertakings continue at high level. The number of individual openings covered by standard inquiries (as received from month to month) was 677 as at the end of February. In addition, openings specifically reserved for, or of particular interest to, ex-service personnel numbered somewhat over 400. Under the Science Students Regulation, employers engaged in high priority undertakings have registered requests for a further 1,000 technical persons from the graduating class of 1945. As against these needs the numbers available or likely to become available will continue to show a substantial deficit until there is a greater flow of technical personnel back to civil life from the Armed Forces.

AIDS TO RESEARCH

It will be gratifying to Canadians to learn that there are signs of an increasing interest in research in this country. Tangible evidence of this is the installation of an electron microscope by at least four different organizations—the University of Toronto, the National Research Council, McGill University and the Shawinigan Chemicals Co.

Papers presented at annual meetings of the Institute by C. J. Mackenzie, president of the National Research Council and A. F. G. Cadenhead, director of research of Shawinigan Chemicals Limited, gave a rude shock to many engineers who had not appreciated Canada's low attainment in this field, particularly from the industrial angle. The enterprise of these four institutions will be encouraging to all who appreciate the value and the need of an expansion in Canadian research.

The new electron microscope is much larger than the familiar light microscope, standing six and a half feet high and weighing about twelve hundred pounds. Instead of rays of light and glass lenses it uses a beam of electrons and electromagnetic lenses. Since electrons can move freely only in a vacuum the whole "optical" system of the microscope has to be sealed and evacuated.

The versatility of the electron microscope is shown by the fact that it will provide magnifications ranging from that of a low-power light microscope to fifty times higher than the best obtained with the highest power of an ordinary microscope. This makes it possible to study minute organisms and particle structures which are beyond the range of ordinary microscopes.

The first commercial electron microscopes on this continent were made in 1940. Since then the number in use by industrial, government and college research laboratories has grown until to-day there are more than seventy in service. Experience already gained by these investigators has proved the instrument's value and it has been credited with important contributions to science and technology in the fields of chemistry, metallurgy, textiles, agriculture, medicine and food processing.

Interest in this new research tool is so great that Canadian and American scientists have formed the Electron Society of America to aid in the exchange of information on microscope techniques and experimental results.

BEHAVIOUR OF SUSPENSION BRIDGES

The following report from Dr. P. L. Pratley was presented to Council at the March meeting. The Board upon which Dr. Pratley represents the Institute was established shortly after the spectacular collapse of the Tacoma Narrows bridge and largely because of that disaster which indicated strongly the need of most exhaustive studies of the behaviour of suspension bridges.—Ed.

To the President and Council,

The Engineering Institute of Canada.

In March 1943 you were good enough to sponsor my appointment to membership in the Advisory Board for the Investigation of Long-span Suspension Bridges, organized by the Public Works Administration of the United States Government in Washington, D.C., following the reports on the collapse of the Tacoma Narrows bridge. I conceive it as only proper that some report of my activities in this connection should be rendered from time to time, and only the fact that there has been so little that could be reasonably released for such purposes has delayed my submitting an earlier memorandum. Even now, my report will be merely a general statement of progress, outlining the operations of the Board and my personal relationships thereto.

The Board consists of some 27 members under the chairmanship of Mr. F. E. Kelley of the P.W.A. and includes most of the outstanding practising engineers of the United States in this special field, together with several prominent representatives from the academic, laboratory and directive spheres. I am the sole Canadian representative.

Besides the Executive Committee of five members, and two other five-member committees on Finance and Publications, there are three large working committees, known as "Field Observations," "Model Studies," and "Interpretation and Analysis". I have been assigned to two of these, namely, Field Observations and Interpretation and Analysis. The latter has been the more active,as the former has been faced with the difficult problem of designing, producing and installing certain recording instruments, the manufacture of which cannot rate as a war interest.

The Committee on Interpretation and Analysis, under the chairmanship of Mr. Conde B. McCullough, assistant chief engineer of the Oregon State Highway Commission, has concerned itself with the collection, compilation and classification of data regarding existing suspension bridges—and some non-existing,—their design and behaviour, and with mathematical studies of varying degrees of complexity, concerning such questions as vibration, rigidity, energy absorption, the effect of towers, side-spans, stays, continuity of construction, and bracing systems. As might be normally expected, differences of opinion are found to exist regarding the relative importance of this or that approach or viewpoint, the various physical factors and even the objectives, and much interesting interchange of correspondence has eventuated.

Very valuable academic treatises have been produced on some of the above questions, particularly on the study of vibration distortions, modes and frequencies, and on the distribution of energy among the contributory parts of a suspension bridge structure as vibratory movement takes place. The development of the energy differential equations for a conservative system, and the use of Fourier series for expressing the shape of the vibration curves, have given rise to sundry "pretty" algebraic treatments, and correspondingly convenient formulæ.

Several efforts to establish useful practical criteria of stability under vertical and horizontal loadings have been made—some empirical and others analytical in nature—and the discussion on the value, the applicability and the weaknesses of these proposals has been stimulating.

What the final outcome of the investigation will be cannot yet be envisaged; what direction it will take cannot be foreseen; what degree of finality will attach to the findings cannot be even remotely conjectured; but to those actively participating in the studies, the experience is most fascinating and will surely prove to be valuable to the profession.

No call has been made on the appropriation set apart by the Council for possible financial outlay in this connection as, up to the present, no expenses beyond postage for a rather voluminous correspondence have been incurred.

Respectfully submitted,

(Signed) P. L. PRATLEY, D. ENG.

LETTERS ABOUT SALARIES

Recently the *Journal* has received several letters complaining of the remuneration given to engineers and making suggestions as to methods of improvement.

The Publication Committee has examined the communications and proposes printing them in the *Journal*, but in the meantime has asked the Committee on Employment Conditions to consider them and to submit its comments and suggestions, also for inclusion in the *Journal*. In this way it is hoped that the authors of the letters may have adequate and helpful answers.

There is no topic that prompts sharp discussion like salaries, but while admitting there is need for improvement in many places, it should not be assumed that all employers are poor pay. Many engineers are sweeping in their condemnation of employers, but on the other hand there are thousands who admit that their remuneration is reasonably adequate and that they are satisfied.

In examining the situation to discover why some engineers are badly paid, generalities should be avoided. It will be found that the fault lies with the individual employer—or perhaps with the individual employee, and not with the whole group.

GOVERNMENT COMMITTEE ON PAYMASTER MINES DISASTER

Dean C. R. Young, M.E.I.C., past-president of the Institute, has been appointed chairman of a Committee appointed by the government of the Province of Ontario to investigate technical matters connected with the recent serious accident at the Paymaster Consolidated Mines, Limited, Porcupine Camp, resulting from the breaking of a hoisting cable and the fall of a cage in shaft No. 5. The other members of the Committee, all of the University of Toronto, are: Professor E. A. Allcut, M.E.I.C., head of the Department of Mechanical Engineering, Professor T. R. Loudon, M.E.I.C., head of the Department of Civil Engineering, Professor L. M. Pidgeon, head of the Department of Metallurgical Engineering, and Professor V. G. Smith, of the Department of Electrical Engineering.

TRENDS IN EDUCATION

Engineering and Business Course at Toronto

Recognizing that an ever increasing proportion of engineering graduates find their life work in business or administration and that further development of the qualifications of the engineer in this field is opportune, the Faculty of Applied Science and Engineering of the University of Toronto has established an undergraduate course in Engineering and Business, effective with the commencement of the regular session in September, 1945. The pronounced interest expressed by men in the armed forces in courses in business and administration, often accompanied by an equal interest in technology, has given special point to the introduction of the course at this time.

The course commences in the second year, students being admitted to it after having completed the first year in any of the regular courses, except Architecture. The second year has as high a scientific-technological content as the second year of any of the traditional engineering courses. It is rather closer to the second year in Mechanical or Electrical Engineering than any other second year, but a differentiation had to be made in order to provide a logical sequence of studies in the entire four-year programme.

In the third year of the course about 33 per cent of the time is assigned to subjects in the field of accounting, statistics, applied economics, and industrial management. In the fourth year, about 46 per cent of the time is devoted to these subjects, with the addition of business policy, engineering economics, and engineering law. In each of the four years of the course, an additional 6 per cent of the time is devoted to liberal or humanistic-social studies.

Of the total time of the four years of the course, about 29 per cent is devoted to non-technological studies, including therein the liberal studies as well as those belonging to the business and administrative field. The course is therefore 71 per cent scientific-technological in character, as compared with 57 per cent in the group of nineteen American colleges that offer degree courses in the general field of engineering administration.

Another basis of judgment that is perhaps more appropriate exists in the fact that since the traditional undergraduate courses in such branches as Civil, Mechanical, or Electrical Engineering in the University of Toronto contain 88 per cent of scientific-technological material, the new course in Engineering and Business is 81 per cent standard, judging it purely from the point of view of science and technology.

While consideration was given to the device of lengthening the undergraduate course to five years for students who would register in Engineering and Business, with the first four years as they are in the traditional engineering courses and the fifth year devoted to business and administration, it was felt that for the present at least it would be better to conform to the four-year undergraduate programme. That is the normal policy recognized by the Society for the Promotion of Engineering Education in the report of its Committee on Engineering Education After the War.

PUBLICATIONS OF AMERICAN ENGINEERING SOCIETIES

Exchange arrangements exist between The Engineering Institute of Canada and the founder engineering societies of the United States, whereby members of the Institute may secure the publications of the American 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 may either be sent direct to New York or through 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*	5.00*
(* Plus 50c. postage.)	to 10.00	to 10.00
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.

L. Austin Wright, *General Secretary,*
2050 Mansfield Street, Montreal.

MORE ABOUT CIVIL SERVICE SALARIES

Two things have caused a recent revival of general interest in the subject of salaries paid by governments — municipal, provincial and federal — to their engineers.

The federal civil service has secured from the Treasury Board authorization for a substantially increased schedule for certain engineers to be employed on post-war projects. After months of futile endeavour by various departments to secure engineers to work on the post-war programme, the Board has at last seen the light, or at least a flicker.

With a situation that could not be denied and that could not be ignored, the purse strings were loosed to a limited extent and to a limited few. There has been no widespread breakdown in the much criticized policy of the government, but just a slight breach in the wall forced by sheer necessity.

For post-war work only, and so far as the *Journal* can discover, in the Department of Public Works only, a new scale has been established. Four new classifications have been created "Engineer Grade 1, 2, 3 and 4" as shown in the following tabulations. The top salary is only $4,200 but the responsibilities sound much higher. It is doubtful if men with these qualifications will be secured at a starting salary of $3,600 with a top of $4,200 when industry is paying that much for young men back from the war who had almost no experience when they enlisted.

The qualifications for "Engineer Grade 4" sound like the general superintendent of a large contracting firm. The Institute survey showed that contractors pay such persons from $6,000 to $8,500, and for the best men even higher. It is not likely that the government will get much choice at the prices offered. The specification is

Engineers — Grade 4:—

"Duties: To have complete charge of several projects and to be responsible for the work of the engineers assigned to each together with their assisting staff; to represent the District Engineer in contacts with representatives of public bodies and Members of Parliament; to carry on technical correspondence and to perform other responsible work as directed by the District Engineer."

Another feature that cannot pass unnoticed is that older employees of the department doing the same work are not eligible for the new salaries. There appears to be underway the creation of an impossible situation wherein senior engineers with years of service will be asked to instruct and oversee the work of new men who will be working for them at substantially higher salaries. Just how anyone knowingly could set up a situation like this is difficult to understand unless eventually it is intended to make the new scale applicable to the present employees. Decency, fair play and business sagacity would indicate there was no other way out of it, but where the Treasury Board is concerned such factors may be considered of less importance than they are elsewhere.

Just to emphasize the ridiculousness of the situation, examine the following tabulation. When the boss gets $900 a year less salary than the man working under him, something is likely to happen — and should.

New Scale for Post War Projects

Engr. Grade 1	$1,800 — 2,400
" " 2	2,400 — 3,000
" " 3	3,000 — 3,600
" " 4	3,600 — 4,200

Comparable Scale for other Engineers

Junior Engineers	$1,800 — 2,160
Asst. Engineers	2,220 — 2,700
Senior Asst. Engr.	2,820 — 3,300

For years, the Institute has been pleading for decent wages for government engineers. The new scale even in its limited application is helpful, not because it provides any relief to existing employees, but because it is an admission of the inadequacy of the regular scale. Perhaps it is the thin edge of the wedge, and reform will follow. Is it too much to hope that these professional men will be paid a living wage — not because competition has forced it in an isolated case, but because decency demands it, good business prompts it, and the men have earned it?

Montreal Shows the Way

Usually, municipalities pay poorer wages to engineers than do other government bodies. A survey made last year by the Corporation of Professional Engineers of Quebec showed that the City of Montreal was no exception. At the time of the 1944 strike of Montreal municipal employees, the engineers did not walk out, but they did ask for some amelioration of their financial conditions. C. C. Lindsay, president of the Corporation of Professional Engineers, and deGaspé Beaubien, president of the Institute, in response to a petition from the employees, together visited the municipal authorities on behalf of the engineers; also the employees at a meeting held at the Institute established "Le Comité des Ingénieurs Municipaux" to represent them.

The committee studied the problem and presented to the Executive Committee of the City of Montreal a brief full of sound arguments and sensible proposals. The result was that a new scale was established that marked a definite advance toward fair wages. The old and new scales are given below.

Engineer	*Old*	*New*
Grade 1	$1,800 — 2,040	$2,400 — 2,520
" 2	2,100 — 2,400	2,700 — 3,180
" 3	2,460 — 2,820	3,300 — 3,780
" 4	2,880 — 3,300	....
" 5	3,360 — 3,780	3,900 — 4,500
Section Engineer	3,300 — 3,600	4,200 — 4,800
Group Leader	3,900 — 4,500	5,100 — 5,700
Asst. Supt.	3,900 — 4,800	4,200 — 4,800
		5,100 — 5,700
Superintendent	5,700 — 6,300	5,700 — 6,600
		6,900 — 7,500
Asst. Director	6,600 — 8,000	7,500 — 9,000

The new scale has meant a lot to the employees. Previously 36 per cent were paid between $2,000 and $3,000. Under the new scale only 1.5 per cent are at that low level, but 50 per cent are getting from $3,000 to $4,000 as opposed to 35 per cent under the old scale. Twenty per cent are now between $4,000 and $5,000, instead of 12 per cent, and from $5,000 to $9,000 there are now 29 per cent, whereas formerly there were only 16 per cent.

This new schedule removes Montreal from the bottom of the ladder and places it above the provincial and federal governments as an employer. Perhaps this will encourage others to do something, for it is nothing of which to be proud to be known as the payer of the poorest wages—nor is it good business.

In British Columbia

A new scale of salaries has been agreed upon recently for the public works engineers in British Columbia. While the scale is still not anything to be overly enthusiastic about, it does go a considerable distance along the road to proper recognition.

One factor that holds back the setting up of a really proper salary scale in British Columbia is that the salary paid the Deputy Minister is low, and that sets the ceiling. The same is true in the federal field, and in all the provinces. There seems to be a need for recognizing that a professional man should be paid what he is worth, instead of an arbitrary figure of something less than the Deputy Minister. Perhaps the deputies should get more, particularly when their profession is related to the work being done by their departments as in law and engineering.

In Other Provinces

The Province of Quebec still pays shameful wages to the majority of its engineers. For a time last year, due to the efforts of the Corporation of Professional Engineers, it was thought that some increase was to be authorized generally, but to-day things are just where they were. The *Journal* is informed that a few increases authorized in 1944 were cancelled when the government was changed later that year. It is too bad that professional employees working industriously and loyally should be the victims of political chance. Such things must react eventually to the detriment of employer and employee alike.

In Ontario, there is also a move on to improve conditions, prompted largely, the *Journal* is informed, by the Association of Professional Engineers. Ontario engineers are more fortunate than those employed by other provinces, but that still leaves a large margin for improvement. It is to be hoped that shortly this margin will disappear.

Generally

All in all there seems to be the beginning of a move in the right direction. Large bodies move slowly, but enough time has passed that some progress should be visible — much more than can be seen at present. It is everyone's wish that the present interest in recognition of the profession may be both widened and accelerated shortly.

WASHINGTON LETTER

Lend-Lease and Post-War Economy

The bill providing for the extension of the Lend-Lease Act for a further year and a clean-up period until June of 1949 has been passed in the House by an overwhelming majority. The bill has now gone to the Senate and it is not expected that it will encounter any difficulty. The Act was extended, however, only after considerable controversy in Committee and after an amendment had been adopted banning Lend-Lease as a postwar measure and the use of Lend-Lease funds for any purpose of postwar "relief, rehabilitation or reconstruction." Congressional pressure for this amendment was probably increased as a result of the announcement of the French Lend-Lease Agreement for just under three billion dollars, considerable portion of which was for long term capital equipment. It is true that France agreed to pay cash over a period of thirty years for this equipment. It is also true that France agreed to pay cash for that portion of the remainder which is not delivered before the termination of the life of the Act. Clause 3 (c) of the Lend-Lease Act was invoked in an unprecedented manner to facilitate the French Agreement.

There are two major economic considerations underlying American trade and export policies. On the one hand, very considerable pressure is developing for a large increase in American exports. The goal of full employment does not seem to be realizable except in terms of at least a three-fold expansion in normal export levels. The maximum pre-war export trade occurred in the year 1929 at something over 5 billion dollars. U.S. export trade, after a serious slump to about one and a half billion, rose to just over three billion in 1939. During the war, the normal export level has been maintained fairly well and to this has been added about thirty-five billion dollars worth of Lend-Lease over the last three years. At first sight, the goal of increasing normal U.S. export trade in the order of three or four times should not be too difficult, at least for a year or so in the postwar period. Gold and dollar reserves held in the U.S. by outside countries is at present standing at about twenty billion dollars. This is approximately four times what they were at the end of the first world war. In addition, extensive credits will probably be made available. French credits under the Lend-Lease agreement will approximate three billions. The Russians are still discussing the possibility of a six billion dollar credit and British credit requirements may also be in the same order. Credits will also probably be extended to China, the Netherlands, and to some of the smaller nations. Additional financing will also be possible through the International Bank and the Monetary Fund, if the Bretton Woods proposals are accepted, and through the Export-Import Bank. Coupled with these financial considerations, the world wide demand on U.S., particularly for capital goods, tools, and machinery, will be tremendous. Not only will the requirements of reconstruction and rehabilitation be very large, but the world-wide capacity for producing heavy and capital goods has been very much reduced by the war and little in the way of repair or replacement has been possible over the last five years. On the other side of the picture, however, there is an increasing awareness that exports cannot be continued indefinitely except insofar as they are balanced by imports. There is also the growing realization that American capacity to produce the type of goods which will be required is inadequate unless serious inroads are made on domestic requirements. The pressure for export trade may be great in this country but pressure directed to the maintenance of the standard of living and the supply of civilian goods and services will probably be even greater. There has been manifested recently an increasing public alarm lest the domestic economy suffer in order to take care of foreign countries. It can be argued that the only way of absorbing the devastation of war without disrupting national economies is to spread the load evenly over all economies concerned. This would mean that devastated countries would be built up at the expense of those countries which had been more fortunate. This is a proposition which unfortunately cannot easily be sold to the man in the street. As a result of these growing pressures in respect to exports, War Mobilization Director Byrnes has set up a new Inter-Agency Committee to be known as the War Export Control Committee. This is a high level committee, chaired by Crowley of F.E.A., with Clayton, Assistant Secretary of State, Conway of W.S.A., Krug of W.P.B., Somerville of the War Department, Strauss of the Navy Department and Jones of W.F.A. as members.

Complexity of Rehabilitation Problem

The interdependence and inter-relation of the problems of the world become more obvious as the situation becomes more complex. Tied in with the whole question of international trade and international finance, the following are some of the matters which are exercising authorities here in Washington. The drastic deterioration of economic and social conditions in the reoccupied countries continues to give grave concern. President Roosevelt has sent Judge Rosenman on a special mission to return the Law mission visit to this country some months ago on the question of civilian supplies for the relief of Europe. Rosenman is also reputed to be preparing a report on the credit and financial aspects of rehabilitation. It is expected that the Export-Import Bank will have its functions considerably enlarged. Within the near future a concentrated attempt may be made to repeal the Johnson Act which would clear the way for the granting of credits to debtor countries from the last war. Difficult policy decisions will have to be made with respect to the disposal of surpluses and the currency and exchange problems involved. Bretton Woods proposals are still subject to widespread debate. Preparations are being rushed for the Security Conference at San Francisco. The war has demonstrated, beyond any question, the tremendous productive capacity of the modern industrial age. The mere engineer is left somewhat bewildered by the complications of keeping this productive machinery going once the over-riding necessities of destructive war have been removed.

Post-war Merchant Fleet

Shortly after the signing of the French Lend-Lease Agreement it was announced that a large item for charter and cargo vessels had been eliminated from the agreement. The whole question of the future of the vast American merchant marine fleet is also occupying a very important place in postwar planning and thinking. The fleet is now estimated to consist of well over 5,000 ships totalling fifty-five million tons. This is a fleet about five times the size of the prewar merchant marine of the United States and is in excess of the combined prewar fleets of the five leading maritime countries of the world. About thirty of the fifty-five million tons represent over-age vessels and Liberty ships, all of them too slow or too costly for postwar competition. The remaining twenty-five thousand tons comprise something over two thousand ships, including the new Victory ships, which are fast and economical in design. In the case of the obsolete fleet, the problem of disposal is of major magnitude. The use to which the modern fleet can be put will be tied up with export policies and with the effect that such use might have on the economies of other mercantile nations. The most significant consideration of all, of course, will be the question of what these ships will bring back to the shores of the United States.

The Liberator Bomber

The Ford Motor Company recently announced the delivery of the 8,000th Liberator bomber from the Willow Run plant. The Ford announcement went to some pains to point out the difficulties which had been encountered with respect to design and engineering changes. More than 1,000 master changes had been made since production commenced in 1942 and, on an overall basis including minor changes, alterations over a period of more than a year averaged about 200 daily.

Synthetic Rubber's Future

A recent survey of the rubber situation reports that the government-owned synthetic plants at present in production represent a total investment of about $750,000,000 and are capable of producing about a million tons of synthetic rubber per year. This is about the equivalent of the expected available natural rubber production once the plantations are restored to their prewar level. This, however, will take some years after the end of the Japanese war. The pent-up demand for rubber will probably take care of both sources for the immediate postwar period but a five to ten year period of competition between synthetic and natural rubber is expected before consumption is large enough to take care of the full ouput of both sources.

The Remagen-Ludendorff Bridge

It is too bad that the exigencies of war do not permit time for scientific investigations, but it would have been extremely interesting to have had an analysis from a design point of view of the extent of the damage to the Remagen-Ludendorff bridge prior to its capture, and an analysis of its functioning during the ten days prior to its final collapse. Having regard for the nature of the span, I was intrigued to read in the earlier reports that only the central span was down. Subsequent photographs corrected this preliminary piece of information.

March 21st, 1945. E. R. Jacobsen, M.E.I.C.

CORRESPONDENCE

An Appreciation

Dr. L. Austin Wright, Secretary, March 5, 1945.
The Engineering Institute of Canada,
Montreal, Canada.

My dear Dr. Wright

I would like to compliment you on *The Engineering Journal*. The story about Steep Rock, in four chapters, in the January issue is fascinating. I have passed it on to some of my friends, professors of mathematics, who declare the Steep Rock series to be as interesting as a first class detective story. The series of articles about Shipshaw in the April, 1944, issue were just as good.

What I like about the Institute and its *Journal* is its catholic nature. Some of us like to, nay have to, specialize narrowly. In doing so there is danger of losing the broad perspective. You know, here, to the south of the border, we have broken down into a large variety of engineering societies with their respective journals. This process, with us, is still going on. This may be all right, but as variety is the spice of life, I hope the Institute is not going to succumb to this same tendency. To me, anyway, you publish the most readable engineering journal on the North American continent. More power to you. If I have one criticism, it is this. I wish you would see to it that the *Journal* gets at least into all the engineering libraries in the U.S.A.

Very sincerely yours,

(Signed) J. A. Van den Broek

Professor, Engineering Mechanics, University of Michigan, Ann Harbor, Mich.

Engineers at the Front

Chief Engineer's Branch,
H.Q. 2nd Cdn. Corps,
B.L.A., C.A.O.

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

Dear Sir:—

I have just received your letter stating that my wife had sent you my address overseas. I arrived at this H.Q. on January 14th to take up a staff job which goes under the questionable title S.O.R.E. — Staff Officer Royal Engineers.

Thank you very much for your kindness in remitting my fees during service overseas. I should very much like to keep my subscription to your excellent *Journal* and I think that by now my wife will have told you so.

The country in these parts could be country in any land — Canada, U.S.A., England — but the weather is definitely not up to the par to which we are accustomed. At least at home we have either heat or cold while here we are at just that stage of chilly dampness which is most uncomfortable. Heavy woollen socks and sweaters are a heaven-sent blessing and the only thing to combat the weather.

The feats of bridging and road work which have been accomplished by the Engineers would gladden the heart of any civil engineer. The British Bailey Bridge is one of the neatest, simplest and most efficient bridges which I have ever seen and yet it is divisible into man pack loads so that working parties can transport it into areas where transports cannot get for tactical reasons. Some of the high level bridges in Holland would be worth touring.

Repairing and construction of roads is another great headache. It is inconceivable how many lorries an army puts on the roads daily and maintenance alone presents a great problem.

Yours sincerely,

(Signed) (Major) Geoffrey Dewar.

Need of Revision in Professional Legislation

Saint John, N.B.
March 21st, 1945.

The Editor,
The Engineering Journal,
Montreal.

Dear Sir:

No doubt the recent decision in the case of the Province of Quebec Association of Architects vs. Brian R. Perry, being adverse to the rights of engineers in such matters, will cause some perturbation among other engineers throughout the Dominion.

I believe those engineers who do not practise in the province of Quebec will have nothing to fear from the judgment.

The Engineering Institute of Canada deserves credit for having foreseen and provided for such a contingency when its committee drew up the terms of the "Model Act"* for registration of engineers in 1919. The Institute, being the "father" of registration, cannot be blamed for overlooking even such an apparently remote possibility as one professional body taking action against the livelihood of the members of another on a technicality. The "Model Act" contained provision, in its definition of the practice of engineering, for the design and construction of buildings in the nature of industrial work. All provinces except Quebec incorporated some such provision in the definitions in their respective Acts.

It will be wondered why the Quebec Act omitted it. It is well known that the "Civil Engineers' Act" of Quebec does not follow the "Model Act" of the E.I.C. except for a few administrative details. The writer has always understood this to be because those engineers who were in the driving seat at that time in P.Q. thought that it would be easier to obtain amendment to the old Quebec Act than to have it repealed in favour of an entirely new form. It is, of course, unfortunate that the definition clause was not amended at the same time. The Institute had nevertheless given the lead but it was up to the provincial authorities to make use of their guidance.

Perhaps the moral of the present situation is that in national council there is greater strength than in sectionalism. Those who have seen something of the confusions and vexations arising from the present variations of the provincial acts, and there are very many, appreciate that such troubles arise in almost direct proportion to the variation of those acts from the "Model". The time is now ripe for a new "Model" upon which all can agree, including Quebec.

Yours very truly,

C. C. Kirby, m.e.i.c.

*See Engineering Journal, May 1919, p. 411.

Electric Heating

23 Java Street,
Ottawa, Ontario.
February 16th, 1945.

Mr. L. Austin Wright,
The Engineering Institute of Canada,
Montreal, Quebec.

Dear Mr. Wright:—

Mr. Massue, on Wednesday, February 14th, delivered his intensely interesting address on "Electric and Other Methods of Heating" to the members of the Ottawa Branch.

A great part of his address had to do with the impracticability of electrically heating large numbers of dwellings, and his conclusions are so nearly similar to those which it was my privilege to set down on paper for Mr. C. A. Magrath, the Fuel Controller during the other Great War, that it occurs to me you would perhaps think it worth while to print in the *Journal* the memorandum which I made for Mr. Magrath so many years ago.

I take pleasure in sending you herewith a copy of the memorandum mentioned above.

Believe me,

Yours sincerely,

(Signed) John Murphy.

❖ ❖ ❖

Electric heating, with energy from hydro-electric plants, is a problem which the public seems to like to discuss. But the Fuel Controller is of opinion that the substitution of electrical energy for fuel in domestic heating cannot play an important part in solving Canada's fuel problems. There are three reasons for that conclusion: First, although the potential capacity of our water-powers is enormous, they are insufficient to electrically heat our present homes — to say nothing of future growth, and at the same time to meet our light and power requirements; secondly, the tremendous cost of the power plant and of the power-transforming and transmitting equipment — all of which would of necessity be in use at the same time in cold weather, and none of which would be needed for heating in warm weather — puts electric heating beyond practical consideration; and, thirdly, because the proposal to use electrical energy for heating is based upon unsound scientific principles. When electrical energy is to be transmitted from one point to another, wires of ample dimensions are employed so that the resistance losses—analogous to friction losses in a water-piping system — shall be reduced to a minimum. Electrical energy is a high grade type of energy, which should not be wasted. But in the ordinary electric heater the heating element is in the form of resistance, and all the electrical energy in question is thus " degraded " from a high type of energy to a low type.

It requires about 25 horse-power of electrical energy to heat a well-built eight-room house. Ottawa, with a population of about 100,000 had some 25,000 buildings of all types. To electrically heat 20,000 houses, for example, each needing 25 horse-power, at the same time would entail a power plant and transmission installation of 500,000 horse-power; this is 25 per cent more power than the total capacity of the three large power companies at Niagara Falls, Ontario, and it is about five times as much energy as is normally available from the whole of the Ottawa river at Ottawa and Hull.

To obtain for one hour 25 horse-power in the form of mechanical energy from coal in a steam-power plant, requires in plants of 1,000 to 2,000 horse-power, the consumption of about 100 pounds of coal. But to obtain the equivalent of 25 horse-power for an hour from a coal-burning furnace, in the form of heat, only requires the consumption of less than 10 pounds of coal — even when 50 per cent of the heat is lost " up the chimney." Therefore, by making proper use of power from water falls, more than ten times as much coal can be saved by replacing steam engines by electric motors, as could be saved by replacing coal furnaces by electric heaters.

If we had so much water-power, developed and undeveloped, that there was no economical use for it, now or prospectively, there might be some excuse for advocating electric heating. But when ten times as much coal can be saved at every point where electric motors replace steam driven machines, as could be saved by the same amount of energy used for electric heating, our conservation efforts should be centred on the electric power question — not on the electric heating question.

The connection of electric heaters to new power plants which have spare capacity, tends to create conditions most difficult of correction later on when the power becomes needed for more economical operations. In this respect it is analogous to the exportation of power in the early days when there was no demand for it in Canada. When the use of power — or the enjoyment of any privilege — is once established, the attempted revocation of that use or privilege may be attended by very difficult and complicated consequences.

As an instance of what may be accomplished in the conservation of coal by using electricity to take the place of mechanical energy created from coal, it might be pointed out that in Montreal, at the instigation of the Fuel Controller, some 43,350 tons of coal were saved during the twelve months ending March 31, 1919, as the result of an arrangement whereby the Montreal Tramways Company purchased power from the Montreal Light, Heat and Power Company as an auxiliary supply. Similar arrangements have been made with twenty-seven other users of coal in the Montreal district, effecting an additional saving of over 1,200 tons yearly. In other parts of Quebec province over 25,000 tons were similarly saved last year.

The municipal corporations of Montreal and of Winnipeg had opportunities to effect yearly coal savings of about 30,000 tons and 10,000 tons, respectively, by purchasing power on the one hand for pumping water at Montreal, and, by selling power in the other case to the street railway at Winnipeg; but as these municipalities did not take advantage of the situations arising out of the Fuel Controller's appeals for conservation, those possible savings cannot now be recorded.

MEETING OF COUNCIL

A meeting of the Council of the Institute was held at Headquarters on Saturday, March 17th, 1945, at nine-thirty a.m.

Present: President E. P. Fetherstonhaugh (Winnipeg), in the chair; Past-President deGaspé Beaubien (Montreal); Vice-President J. E. Armstrong (Montreal); Councillors R. S. Eadie (Montreal); R. C. Flitton (Montreal), E. V. Gage (Montreal), P. E. Gagnon (Quebec), J. A. Lalonde (Montreal), C. C. Lindsay (Montreal), R. A. Low (Kingston), P. E. Poitras (Montreal), W. L. Saunders (Ottawa), J. F. Wickenden (Three Rivers), W. S. Wilson (Toronto); Treasurer R. E. Chadwick (Montreal); S. R. Frost, chairman of the Toronto Branch, and J. B. Stirling, chairman of the Montreal Branch and chairman of the Committee on Professional Interests; General Secretary L. Austin Wright, and Assistant General Secretary Louis Trudel.

Rehabilitation of Members in the Armed Forces—The general secretary reported that the voluntary assessment proposal to meet this additional expense was being well received by the members. Less than one per cent of those who had paid their fees to the end of February had cancelled the item from their account. A total of $2,685.00 had been collected for the fund from about one third of the members who had paid their fees up to that time. In several instances members had contributed amounts well in excess of the minimum mentioned on the account.

He went on to point out that the real difficulty seemed to be in finding the right person for the position. The opening has been advertised in the *Journal* both on the editorial page and on the employment page, and he had spoken about it to almost every branch in Canada, and yet the number of persons applying was very small, and most of them did not have the complete combination of qualifications that was being sought.

Community Planning—The general secretary reminded Council that at the meeting in Winnipeg a resolution had been passed stating the Institute's interest in advancing the subject of community planning and that in response to instructions from the Council he had informed the president of the Royal Architectural Institute of Canada that Council was agreeable to co-operating with that organization in order to establish a central organization for the work. He reported that no reply had been received as yet and that therefore no further progress had been made.

The general secretary read a resolution from the Association of Professional Engineers of Saskatchewan supporting the Institute in its policy. It reads as follows:

> "Whereas advances in mechanical progress consequent upon the war will have a tremendous impact on the ways of Community life after the war and; whereas the vast majority of Canadians live in Communities both urban and rural and; whereas the use of land conditions Community environment and; whereas the physical structure of a community is conditioned by the economic base of the community, the municipal tax structure, the municipal system of assessment, the land use and subdivision plan and the regulations which govern the height, bulk, spacing and use of buildings and structures built upon the land and; whereas the scope of community planning embraces consideration of all these aspects of community development and; whereas the art of bringing these phases of community development and organization into their proper relationship is a function of engineering: it is therefore resolved that the Association of Professional Engineers of Saskatchewan in annual session is in full accord with the policy of The Engineering Institute of Canada, declared at the annual meeting of the Institute held in Winnipeg, Manitoba, February 7 to 9, 1945, to promote and stimulate public interest in proper community planning and development throughout Canada, and wishes at this time to request the Institute in co-operation with other authorities to take whatever action is necessary to have A Community Planning Institute of Canada established with the least possible delay and in order that all spheres of government in all parts of Canada may participate and in order that all may receive the benefit of the accumulated knowledge of each."

Again urging the necessity of the Institute taking action, the general secretary recommended that a further endeavour should be made to meet with Messrs. Bunnell and Page and other interested parties in Toronto without further delay. There was a long discussion in which Messrs. Low, Frost, Gagnon, Chadwick, Lalonde, Flitton, Poitras and Wickenden participated, out of which came a resolution moved by Mr. Eadie and seconded by Mr. Low, and carried unanimously as follows:

> THAT the Toronto councillors, with power to add to their number, be appointed as a committee to recommend to Council the make-up of the committee on community planning authorized by the annual meeting, and that they also contact Mr. Bunnell and the Royal Architectural Institute of Canada with a view to furthering the establishment of a community planning Institute.

Co-operative Agreement in Quebec—On the motion of Dr. Gagnon, seconded by Mr. Lindsay, it was unanimously resolved that Messrs. J. B. Stirling, J. A. Lalonde and André Benoit be appointed as the Institute's representatives on the joint committee provided for under clause 9 of the agreement between the Institute and the Corporation of Professional Engineers of Quebec for the advancement of co-operation. It was noted that the Corporation representatives on this committee were Messrs. J. A. McCrory, P. E. Poitras, and A. D. Ross.

Employment Conditions—The general secretary presented an interim report from the Committee on Employment Conditions, which referred to the following subjects:

(1) The recent decision of the Wartime Labour Relations Board that professional workers would be included under Order in Council 1003 instead of having a new order for themselves as requested by the committee of fourteen. Mr. Heartz' committee acknowledges a letter from the Minister of Labour which they interpret to mean that engineers may remain as professional units for purposes of bargaining under P.C. 1003 with the right to choose their own bargaining agency, and without trade unions being able to include them against their own wishes in an overall contract.

(2) The joint sub-committee of three has acknowledged the Minister's letter and informed him that before a final reply was made the situation would be carefully studied again. The sub-committee proposes to meet in Ottawa early in April for this purpose.

(3) Reference is made to the Quebec Federation of Professional Employees, stating that the organization has been launched and is now seeking members. The report also states that the board of the Federation has decided to reconsider the constitution under which it is operating. This relates principally to the recommendation of Mr. Heartz' committee that membership in the Federation, as far as engineers are concerned, should not be restricted to members of the Corporation of Professional Engineers.

In the discussion which followed Mr. Lalonde inquired as to whether or not the official support of Council had ever been given to the proposal to establish the Quebec Federation of Professional Employees.

The general secretary referred to a report presented by the committee at the December meeting of Council in which it was stated that the committee recommended supporting the idea of a co-operative group operating a collective bargaining agency for the benefit of all properly qualified professional workers who desired to be included irrespective of whether they belonged to an organization or not. Under these conditions it was recommended that Council would even be prepared to share in the initial financing.

Mr. Wright pointed out that there was a clause in the present constitution of the Federation by which that organization refused to bargain for any professional engineers who were not members of the Corporation. It was because of this clause that Mr. Heartz' committee had not recommended to Council the entire approval of the Federation proposal. The committee felt that such a restrictive clause would tend to develop additional bargaining organizations to include those who did not belong to the Corporation and would therefore establish a multiplicity of bargaining agencies, whereas the best results would be obtained if the field were limited to one.

Mr. Armstrong raised the point as to where draughtsmen fitted in under Order in Council 1003. He stated that in many offices there were large numbers of draughtsmen, some graduates of universities and others not eligible for membership in the Institute or licensing bodies and therefore not eligible for the Federation. He wanted to know if it was the intention of the Federation to bargain for such people or would they be bargained for by a union if they desired collective bargaining.

Mr. Lindsay suggested that such persons could be taken in as students of the Corporation and in this way become eligible for membership in the Federation.

Eventually it was agreed that the Committee on Employment Conditions would be asked to report again to Council on this point.

Engineers and the Design of Buildings—Mr. Armstrong reviewed the situation with reference to the case of the Quebec Association of Architects versus Brian Perry. He explained the Institute's special interest in the court decision and in future developments. On account of the national character of the Institute it was felt that it had a special responsibility in following the case closely and giving support to Mr. Perry and the Corporation. To this end Past-President Beaubien had arranged a meeting of the president and president-elect of the Corporation, Messrs. Lindsay and Poitras, with Messrs. Beaubien, Armstrong, Chadwick and Wright. Unfortunately, on the day of the meeting Mr. Beaubien was ill and could not attend.

At the meeting the whole situation was reviewed and the Institute's interest explained. Mr. Armstrong reported to the meeting that the Institute desired to work closely with the Corporation and with Mr. Perry in the appeal of the court decision and with the Corporation in the action necessary to have the professional engineers' act amended. While at the moment he could not commit Council to financial expenditures he was confident that the Institute was prepared to carry a substantial portion of the costs, and at the same time to appoint representatives who would work with the Corporation throughout the deliberations in determining the future action.

Mr. Armstrong reported that the outcome of the meeting was that it was agreed that the Institute would appoint three representatives to work with three similar representatives of the Corporation to accomplish these ends.

Deterioration of Concrete Structures—The general secretary read a letter from R. B. Young relative to the work of the Committee on the Deterioration of Concrete Structures. In this letter Mr. Young pointed out that the field was a very wide one and because of the expense involved he thought the Institute should select some portion of the field and confine its activities to that. He recommended further that a small temporary committee be appointed to survey the field and bring in a recommendation as to a course of action. If the committee recommends further activity it should be instructed to select a particular problem or problems " which it believes could best be studied in Canada and suggest how the work might be carried out ".

Mr. Chadwick agreed with the contents of Mr. Young's letter. He pointed out that there were already many organizations doing this class of work and he thought the Institute should be certain to determine that it could make a contribution to the subject before undertaking any further activities.

The president inquired as to whether or not it would meet the Institute's requirement if the committee's functions were restricted to reporting the results of the work of the many committees already engaged in the subject.

Mr. Armstrong pointed out that Mr. Young's letter goes farther than that and in order to bring the matter before Council for action, he moved the adoption of Mr. Young's recommendation relative to the appointment of a small interim committee to survey the situation. This was seconded by Mr. Eadie and approved unanimously.

After further discussion it was agreed unanimously that the interim committee be appointed as follows:

R. B. Young, Convenor, Toronto.
E. Viens, Ottawa.
A. G. Fleming, Montreal.
J. A. McCrory, Montreal.

Committee on the Young Engineer—The president pointed out that it had not been easy to find some person to recommend as chairman of the Committee on the Training and Welfare of the Young Engineer made necessary by the death of Harry Bennett. He reported that, on his behalf, the general secretary had made inquiries in several directions, including deans of engineering and other members of the joint national committee, but that up to the present time there was nothing definite to report.

The general secretary reported on a letter and a conversation which he had had with Mr. Kirkconnell of Ottawa, secretary of the joint national counselling committee, in which Mr. Kirkconnell had stated that both he and Mr. Greene, the other member of the committee, had agreed that the person selected by the Institute should also head up the joint national committee. He had expressed the hope that an appointment could be made quickly so that the work could be continued.

The general secretary announced also that a letter had been received from the chairman of the University of Toronto Alumni Counselling group stating that they were interested in knowing the Institute's appointment as they desired to co-ordinate the activities of their group with those of the joint national committee.

Some names were suggested by councillors and eventually it was proposed by the president that these people be interviewed by Vice-President Armstrong and the general secretary, and that if negotiations could not be completed that the matter be left for final selection and decision with the president, the vice-president and the general secretary. This was approved unanimously.

Grading of Skilled and Unskilled Labour—The general secretary reviewed the discussion which had taken place at the meeting of Council in Winnipeg on February 8th relative to an inquiry from Councillor Stenbol. At that meeting it was decided that the matter be left with the president to select a small committee to consider the subject and the appropriateness of the Institute as a body taking action on it. He reported that on the instructions of the president he had reported the situation to a prominent industrialist in the Montreal area asking his advice as to Institute policy.

Mr. Wright read a letter which he had received in reply to this inquiry. The letter reviewed the developments in considerable detail and pointed out that job rating in relationship to skill and quantity of work had been before large employers of labour for a long time and that these factors were behind the job and man rating systems used now in the United States and Canada, particularly in the heavy industries.

While acknowledging the essentiality of the study, the letter stated " it is more an administrative problem than an engineering problem and in our opinion does not require the qualifications which we look for in an engineer." The letter went on to state that in the United States these rating systems were used even by some of the labour unions in their appeals to the labour boards for adequate differentials in rates of wages.

The letter disclosed certain other information which it was felt would be helpful to members of Council and the general secretary was instructed to pass this on to Mr. Stenbol.

Council acknowledged the competence of the author of the letter to advise the Institute. In the discussion which followed the thought was expressed by some councillors that engineers should be interested in job ratings, but it was the more general opinion that while there was no reason why they, as employers, should not be interested in the subject there was no indication that as a profession they had any particular responsibility to it. Eventually it was moved by Mr. Chadwick and seconded by Mr. Flitton that the Engineering Institute should not inaugurate any activity in this field. This was approved unanimously.

Memorandum from Toronto Branch—Mr. Wilson asked Mr. Frost as chairman of the Toronto Branch, to report on a memorandum that was in the course of preparation by the Toronto Branch executive. Mr. Frost explained that some time ago the Toronto Branch had appointed a committee on policy. The committee's findings were largely concluded and it was expected that a final memorandum would be ready for Council shortly. He outlined the form which it was going to take and the field which it covered, and, after a general discussion, it was agreed that the Committee on Professional Interests would meet with the executive of the Toronto Branch at an appropriate time to discuss the subjects in detail, after which the memorandum would be prepared for presentation to Council. This was agreed to unanimously.

The Council adjourned for lunch at one-thirty p.m. and reconvened at three o'clock with the president in the chair.

Financial Statement: It was noted that the financial statement to the end of February had been examined and approved.

Resignation of Vice-President E. B. Wardle: The general secretary read a letter from Vice-President E. B. Wardle, in which he stated that in view of ill health and his inability to participate in meetings of Council, he was submitting his resignation as vice-president. Council was greatly disturbed to receive such a report, and while regretting the conditions that made it necessary, agreed to Mr. Wardle's submission.

In accordance with the by-laws, which provide that a vacancy in the office of vice-president shall be filled until the following annual election by the senior councillor from the zone in which the vacancy occurs, Mr. E. V. Gage, as such senior councillor, was appointed vice-president for the balance of 1945.

The vacancy in the office of councillor will now be filled until the next annual election, by a corporate member chosen by Council from a list of nominees to be submitted by the executive of the Montreal Branch.

Public Works Administration of the U.S. Government: Mr. Wright reminded Council that in 1943 an invitation had been received from a group of engineers in the United States asking the Institute to appoint a representative to a committee being formed to investigate the behaviour of long-span suspension bridges. With the invitation had been a suggestion that Dr. P. L. Pratley would be a very acceptable representative. Dr. Pratley had accepted the appointment and he now presented a progress report which the general secretary read to the meeting. The report was accepted and the general secretary was directed to express to Dr. Pratley Council's thanks and appreciation and to print the report in the *Journal* for the information of all members. (See p. 242).

Association Representation on Council: It was noted that the following representatives of provincial associations of professional engineers had been appointed to the Council of the Institute for the year 1945:

Nova Scotia Association—H. W. L. Doane, Halifax, N.S.

Saskatchewan Association—J. W. D. Farrell, Regina, Sask.

Quebec Corporation—E. Lavigne, Quebec, Que.

Student Prize Memberships: It was noted that at the annual student nights of the Toronto and Montreal branches the following students had presented papers and, in addition to cash prizes from the branch, had received Student membership in the Institute for one year, including the subscription to *The Engineering Journal:*

Toronto Branch

D. E. Becks
R. T. Cavanagh
H. H. Todgham

Montreal Branch

L. A. Dion
D. Noiseux
P. J. Robinson
G. H. Y. Slader.

The Engineering Institute of Canada Prizes: On the motion of Past-President Beaubien, seconded by Vice-President Gage, it was unanimously resolved that The Engineering Institute of Canada Prizes, consisting of $25.00 in cash, awarded annually to each of eleven Canadian engineering schools, be continued for a further period of five years.

Mr. Wilson explained the activities of the Toronto Branch, with particular reference to the Students Night, at which prizes are provided by the branch. He explained that this year the sum of $50.00 for prizes had been made available by a member of the executive who was particularly interested in student matters. This had made it possible to extend the prize list well beyond what was normally possible.

Wartime Bureau of Technical Personnel: The general secretary reported on a meeting of the Advisory Board of the Wartime Bureau of Technical Personnel held in Ottawa on March 16th. He referred at some length to complaints which had come to the Institute both from employers and employees on the operations of the Bureau. He had reported these cases to the Bureau so that the record might be checked. The various complaints were dealt with by the Advisory Board.

The examination of the cases from the viewpoint of the Bureau, revealed a different picture from that which had been reported to the Institute.

The Board discussed these matters at considerable length and decided that the organizations sponsoring the Bureau should endeavour to give the Bureau additional favourable publicity. It was emphasized that the restrictive nature of the Selective Service regulations was certain to cause dissatisfaction with some people, but if those persons and organizations who knew the whole story gave the Bureau the proper publicity it would offset the unfavourable comments made by those who chafed under the restrictions.

Mr. Wright pointed out that the restrictions were not made by the Bureau. They were part of the Selective Service acts and all the Bureau had to do with them was to follow instructions. The scale of priorities for industries was not established by the Bureau and therefore it had no choice in the matters of which complaint had been made.

Mr. Wright suggested that any further complaints that came to Headquarters should be reported in detail so that the Bureau would be given an opportunity to defend itself and at the same time the person making the complaint could be corrected if it was found that he was in error.

Annual Meeting: The general secretary read a letter from Mr. Fred Seibert, the chairman of the Winnipeg annual meeting committee, reporting that the business of the committee was practically completed and now that all accounts were paid it was evident that there would be a substantial surplus. Mr. Seibert reported that the committee was returning this to Headquarters.

Council expressed appreciation of the excellent work done by the Winnipeg Branch. The president reported that according to everything he had heard in Winnipeg the local members had enjoyed extremely the meeting and the preparations for it and that they hoped the Institute would be back again before too many years had passed. He also reported that interest in the Institute had been increased materially both at the university and with the other engineers.

The president reported to Council that the next meeting would be held in Moncton on Saturday, April 21, during his visit to the maritime branches. If any members of Council could accompany him on all or part of the trip he would be delighted to have their support. In any event he hoped that there would be a good representation from the other provinces at the Council meeting.

The Council rose at five o'clock p.m.

ELECTIONS AND TRANSFERS

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

Members

Barratt, Philip S., B.A.Sc. (Civil), (Univ. of B.C.), engrg. dftsman., Cons. Mining & Smelting Co. of Canada Ltd., Trail, B.C.

Cunningham, John, (Glasgow & West of Scot. Tech. Coll.), mgr., North Western Dredging Co. Ltd., Vancouver, B.C.

Ford, Ernest Arthur, B.Sc. (Civil), (Univ. of Man.), asst. contract engr., Dominion Bridge Co. Ltd., Winnipeg, Man.

Hansen, Harold Edward, B.Sc. (Chem. Eng.), (Univ. of Sask.), asst. supt., British American Oil Co. Ltd., Calgary, Alta.

Stiles, Edwin Milo, C.E. (Thayer Sch. of Civil Engrg.), chief engr., Cons. Mining & Smelting Co. Ltd., Trail, B.C.

Juniors

Barker, Frederick George, B.Eng. (Chem. Eng.), (McGill Univ.), fluoride plant supervisor, Aluminum Co. of Canada Ltd., Arvida, Que.

Transferred from the class of Student to that of Member

Smith, Wilfrid Ewart, Elec. Lieut., R.C.N.V.R., H.M.C.S. "Poundmaker," c/o F.M.O., St. John's, Nfld..

Admitted as Students

Barron, J. Leonard (McGill Univ.), 221 Clarke Ave., Montreal 6, Que.

Cavanagh, John Richard, 2/Lt. ,B.A.Sc. (Univ. of Tor.), Officers' Mess, A-5, C.E.T.C., Petawawa, Ont.

Cottingham, David P., B.Sc. (Elec.), (Univ. of Man.), 527 King St., Peterboro, Ont.

Dickie, James Edwin, Douglas Hall, McGill Univ., Montreal.

Fielding, George Parker (N.S. Tech. Coll.), 41 Elliott St., Dartmouth, N.S.

Gregory, John (Univ. of Alta.), 11011-80th Ave., Edmonton, Alta.

Horgan, Frank Joseph, Jr., (Univ. of N.B.), 607 Campbell St., Fredericton, N.B.

Hughes, Robert Bruce Chalmers, B.A.Sc. (Elec.), (Univ. of B.C.), 309 Park St., N., Peterboro, Ont.

Madryga, Alexander, B.Sc. (Univ. of Tor.), 422 Donegal St., Peterboro, Ont.

MacKay, Donald Akerley (N.S. Tech. Coll.), Pine Hill Residence, Halifax, N.S.

MacPherson, Ritchie, B.Eng. (Chem.), (Univ. of Sask.), Laurentide Inn, Grand'Mere, Que.

McCarter, Donal Clayton, B.A.Sc. (Mech.), (Univ. of B.C.), 264 Hunter St., Peterboro.

Moore, Harold James, B.Sc. (Univ. of Tor.), 4239 Oxford Ave., Montreal 28.

Owers, Leonard E. A. (Univ. of Tor.), Elm Avenue, Scarborough, Ont.

Robinson, Patrick John (McGill Univ.), 3434 McTavish St., Montreal, Que.

Szkolnicki, Teddy John (McGill Univ.), 538 Prince Arthur St., W., Montreal.

Tanton, Roy Fraser (N.S. Tech. Coll.), 88 Cedar St., Halifax, N.S.

Weyman, Charles Edward (Univ. of N.B.), 59 Lansdowne St., Fredericton, N.B.

STUDENTS AT ECOLE POLYTECHNIQUE

Asselin, Louis André, 6074 Briand St., Montreal, Que.
Desroches, Raymond, 4623 Hotel de Ville, Montreal, Que.
Huppé, Lucien, 1811 St. Andre Street, Montreal, Que.
LeBlanc, J. Roger, 3724 St. Hubert St., Montreal, Que.
Martin, Jean-Paul, 6361 Molson St., Montreal, Que.
Matte, Paul, 3420 Parc Lafontaine, Montreal, Que.

STUDENTS AT QUEEN'S UNIVERSITY

Brison, Robert Joshua, 164 Barrie St., Kingston, Ont.
Dick, William, Box 152, Cardston, Alta.
Fenton, Stuart William Cameron, 185 William Street, Kingston, Ont.
Oattes, Merle Ebert, Carleton Place, Ont.
Stone, Morton R., 112 Goulburn Ave., Ottawa, Ont.
Sullivan, Harry Morton, 18 Findlay Ave., Ottawa, Ont.
Zabek, Valerian, 211 University Ave., Kingston, Ont.

STUDENTS AT UNIVERSITY OF TORONTO

Becks, Douglas Edwin, 21 Grenville St., Toronto, Ont.
Cavanagh, R. T., 88 Rosedale Heights Drive, Toronto, Ont.
Davidson, Gordon Petrie, 329 Fairlawn Ave., Toronto, Ont.
Lount, Albert Murray, 238 Dufferin Ave., Brantford, Ont.
Morrish, Robert Roy, Cherrywood, Ont.
Paget, Claremont E., 16 Glengrove Ave. W., Toronto, Ont.
Todgham, Herbert Harvie, Jr., 126 George St., Toronto 5, Ont.
Weir, Robert Archibald, 170 Geoffrey St., Toronto, Ont.

STUDENTS AT UNIVERSITY OF MANITOBA

Beverly, William McGregor, 326 Waverley St., Winnipeg, Man.
Kuzyk, Fred Theodore, Poplar Point, Man.
MacLean, Ronald James, 270 Ashland Ave., Winnipeg, Man.
Stocker, William Alexander, 327 Winchester St., Winnipeg, Man.

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:

ALBERTA

Member

Dingman, Charles Willard, chief petroleum engr., Home Oil Co. Ltd., Calgary, Alta.

Transferred from the class of Junior to that of Member

Collier, David Barr, B.Sc. (Civil), (Univ. of Alta.), engr., Northwestern Utilities Ltd., Calgary, Alta.

Corey, Berton Hatfield, B.Sc. (Univ. of Alta.), asst. mining engr., Dept. of Natural Resources, C.P.R., Calgary, Alta.

McEachern, Archibald Calvin, C.E. (Univ. of Sask.), supt., Coast Construction Company, Vancouver, B.C.

Transferred from the class of Student to that of Junior

Lawrence, Norman Alexander, B.Sc. (Civil), (Univ. of Alta.), Lieut., R.C.E., No. 1 Canadian Workshop and Park Co., C.A.O.S.

NOVA SCOTIA

Ganter, Ernest Linwood, E.E. (Polytechnic Institute, Brooklyn), elec. engr., Can. Gen. Elec. Co. Ltd., Sydney, N.S.

Gould, W. Murray, B.Eng. (Mech.), (N.S. Tech. Coll.), president, Standard Construction Co. Ltd., Halifax, N.S.

Newcombe, Stanley Allen, B.Sc. (Elec.), (N.S. Tech. Coll.), acting equipment engr., Maritime Telegraph & Telephone Co. Ltd., Halifax, N.S.

Reynolds, James Russell, B.Eng. (Mech.), (N.S. Tech. Coll.), Commnd. Officer, R.C.N.V.R., asst. res. naval engr. overseer, Halifax Shipyards Ltd., Halifax, N.S.

Stairs, Henry Gerald, 115 Inglis Street, Halifax, N.S.

Transferred from the class of Student to that of Member

Malloff, William, B.Sc. (Mech.), (Univ. of Sask.), mech. engr., Foundation Maritime Limited, Walton, N.S.

QUEBEC

Members

Bertrand, Rene, B.A.Sc., C.E. (Ecole Polytechnique), engr., divn. of streets, City of Montreal, Que.

Crepeau, Armand Charles (Laval Univ.), consltg. engr., Sherbrooke, Que.

Colman, Arthur R., B.A.Sc., (Univ. of Toronto), outside plant standards engr., Bell Telephone Company of Canada, Montreal, Que.

Douglas, James Bruce, B.A.Sc. (Univ. of Toronto), chief engr., West Aeronautical Devices Inc., Montreal, Que.

Gilbert, Marc, B.A.Sc., C.E. (Ecole Polytechnique), M.Sc. (Mass. Inst. Tech.), consltg. engr., Quebec, Que.

Granger, John Maxwell, B.A.Sc. (Mech.), (Univ. of B.C.), chief, mech, inspr., R.C.A.F., R.C.A. Victor Company, Montreal, Que.

Haberl, Herbert William (Carnegie Inst. Tech.), protection engr., Quebec Hydro-Electric Commn., Montreal, Que.

Hawkes, John Milton, B.Sc. (Queen's Univ.), chief engr. & production mgr., Pepsi-Cola Co. of Canada Ltd. ,Montreal, Que.

Laniel, Joseph Albert, B.A.Sc., C.E. (Ecole Polytechnique), dist. engr., Dept. of Public Works, Canada, Rimouski, Que.

Larnder, Ivor Tulk Chesson, B.Eng. (Civil), (Univ. of N.Z.), designing engr., Fraser Brace Engrg. Co. Ltd., Montreal, Que.

Michaud, Joseph Adolphe, B.A.Sc., C.E. (Ecole Polytechnique), woodland supt., Consolidated Paper Corpn., Ltd., Grand Mere, Que.

Milne, James Michael, B.Sc. (Mech.), (Queen's Univ.), steam engr. & safety engr., Donnacona Paper Co. Ltd., Donnacona, Que.

Morrissette, Roméo (Ecole Polytechnique), mayor & consltg. engr., Cap-de-la-Madeleine, Que.

Sorgius, Henry, B.A.Sc., C.E. (Ecole Polytechnique), supt. woods operations, Consolidated Paper Corpn. Ltd., Shawinigan Falls, Que.

Spencer, Walter Hutchins, B.Sc. (Elec. & Mech.), (McGill Univ.), asst. engr., right-of-way divn., Quebec Hydro-Electric Commn., Montreal, Que.

Stearns, Eugene, C.E. (Univ. of Vienna), president & managing director, Concrete Engineering Limited, Montreal, Que.

Trudeau, Alphonse, B.Sc. (McGill Univ.), gen. supt., Atlas Construction Co. Ltd., Ste. Anne de Bellevue, Que.

SASKATCHEWAN

Transferred from the class of Student to Junior

Smith, Will, National Light and Power Company, Moose Jaw, Sask.

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 a basis of personal items in the *Journal*.

Air Vice-Marshal G. O. Johnson, M.C., M.E.I.C., has been appointed to the post of Air Officer Commanding in Chief of the R.C.A.F. overseas to succeed Air Marshal L. S. Breadner whose retirement became effective April 1st. Air Vice-Marshal Johnson joined the Royal Flying Corps in 1917 and was promoted to captain the following year. He was a fighter pilot with a record of 12 planes. He joined the Canadian air force when the armistice was signed and in 1920 took command at Camp Borden. Since then he has been continuously engaged in aviation becoming assistant director of the Royal Canadian Air Force in 1923 and successively holding the posts of assistant director of civil air operations, director of air operations and acting senior air officer with headquarters at Ottawa. He organized the Western Air Command but was recalled to Ottawa in 1939 when he was made a member of the air council and placed in charge of organization and training for the British Commonwealth Air Training Plan which was completed on March 31st last. Up to January, the plan had graduated 122,000 aircrew and employed approximately 15,000 planes. In 1940 Air Marshal Johnson was appointed to the newly created post of Deputy Chief of the Air Staff and two years later was made air officer commanding No. 1 Training Command, Toronto. He transferred to Halifax as air officer commanding Eastern Air Command in 1943, later becoming its air officer commanding in chief.

Brigadier Fraser F. Fulton, O.B.E., M.E.I.C., who has been holding a technical appointment at Canadian Military Headquarters in London, England, since 1943, has been promoted from the rank of colonel. A member of the Royal Canadian Corps of Signals here before the war, he at once went on active service and has been overseas since 1940. He was later attached to headquarters in London and is credited with being the organizer of the Canadian Army's first radio-locator system.

Major-General G. R. Turner, C.B., M.C., D.C.M., M.E.I.C., has recently been appointed Inspector General of the Army for Western Canada, succeeding Maj.-Gen. R. O. Alexander who has retired. General Turner leaves the post of special assistant to the Deputy Minister of Veterans Affairs to take the inspector-generalship. At the outbreak of the present war he went overseas with the 1st Division and from that time until he went on special duty in the United Kingdom in 1943 he handled major problems of administration and supply. He returned to Canada in September 1944.

The following members of the Institute have recently been mentioned in dispatches for gallantry overseas:

Col. George Earle Wight, R.C.A.M.C., Montreal, Que.

Lieut.-Col. A. Scott Rutherford, R.C.E., Montreal, Que.

Capt. (A/Major) J. F. G. Beaudet, R.C.E., Montreal, Que.

Frederick Palmer, M.C., M.E.I.C.

Frederick Palmer, M.C., M.E.I.C., who has spent the last eight years as Canadian Government Trade Commissioner in Australia has been selected to go to Chungking, China, for the purpose of investigating the possibility of Canadian trade with China. Previous to his going to Australia, where much of his work was associated with Australia's war effort, he had served as a Canadian Government Trade Commissioner developing Canada's export trade in Holland, Italy, Norway, Sweden, Denmark, Finland and Great Britain. A native of Belfast, Ireland, he received his engineering training at Nova Scotia Technical College graduating with the degree of B.Sc. in 1913. Mr. Palmer was on active service overseas from 1916 until the end of the war, serving as a lieutenant in the heavy artillery and being awarded the Military Cross.

H. E. Smith, M.E.I.C., now holds the position of production manager for The Silex Company at Hartford, Conn.

Major J. Colin Kemp, D.S.O., M.C., M.E.I.C., has been appointed managing director of a newly formed Canadian subsidiary of George S. Armstrong & Co. Inc., industrial engineers and management consultants. The Canadian subsidiary, located in Montreal, is known as George S. Armstrong & Co. (Canada) Ltd. Mr. Kemp's own practice is now consolidated with the new company, but he will continue to serve as a director on the boards of a number of Canadian corporations.

J. A. Lynch, M.E.I.C., has been recently released from the R.C.A.F. with which he was serving as a flight-lieutenant. He has taken a position with the mechanical engineering division of the National Research Council in Ottawa, Ont.

C. P. Haltalin, M.E.I.C., has been elected chairman of the Winnipeg Branch of the Institute. Born in Winnipeg, Man., he graduated from the University of Manitoba with the degree of B.Sc. (E.E.) in 1929. For three years after graduation he worked on substation design, transmission lines and water power calculations with the Winnipeg Electric Company. From 1932 until 1934 he was engaged in design layout and installation of electric pumping equipment and electric boilers with the same company. In 1934, he became assistant engineer which position he still holds.

Mr. Haltalin joined the Institute as a Student in 1927, transferring to Associate Member in 1934 and becoming a Member in 1940.

Flight-Lieutenant Walter L. Rice, M.E.I.C., has recently been transferred to the headquarters of the newly formed No. 1 Air Command at R.C.A.F. Station at Trenton, Ont. The new command is an amalgamation of the former No. 1 Training Command with headquarters in Toronto and the former No. 3 Training Command with headquarters in Montreal. F/Lt. Rice has been waterworks and sanitation engineer officer in the Construction and Engineering Division of No. 3 Training Command for the past three years and will carry on in that capacity for No. 1 Air Command. Prior to enlisting in the R.C.A.F. he was employed by Defence Industries Limited, Montreal, on the design of waterworks and sewage treatment facilities and is a regular employee on leave from the City of Toronto Works Department.

Victor Michie, M.E.I.C., who has been located in Newfoundland as inspecting engineer with the Department of Munitions and Supply is now with War Assets Corporation in Montreal as chief of construction and engineering department.

James W. Hughes, M.E.I.C.

James W. Hughes, M.E.I.C., electrical engineer with the Canadian Pacific Railway at Toronto, Ont., has been elected president of the Toronto Railway Club for 1945. Mr. Hughes is a past-president of the Canadian Railway Club of Montreal.

F. Jno. Bell, M.E.I.C., has been appointed vice-president and manager of C. A. Parsons of Canada Limited, the newly formed branch of C. A. Parsons & Company Limited, builders of steam turbines and heavy electrical apparatus, with works at Newcastle-on-Tyne, England. Mr. Bell, who is widely known in engineering and industrial circles throughout Canada, has been the Canadian representative of the company since 1924. At one time he also represented other British engineering firms including Messrs. Braithwaite and Company Engineers Limited, London, Eng. He was president and general manager of the Canada Wire and Cable Company, Toronto, and subsequently held the same offices in the Leaside Munitions Company, Leaside, Ont. Mr. Bell later became vice-president of the St. Catharines Steel and Metal Company at St. Catharines, Ont.

Colonel Norman J. W. Smith, M.E.I.C., has recently been promoted from the rank of lieutenant-colonel and is at present connected with the D.C.E. (Works), H.Q. First Canadian Army, Canadian Army Overseas.

Professor R. W. Angus, HON.M.E.I.C., who retired last June as head of the department of mechanical engineering at the University of Toronto, has been awarded honorary membership in the American Waterworks Association. At the banquet of the Canadian Section, held last month, the certificate of honorary membership in the parent body was presented by Samuel F. Newkirk, Jr., president of the Association. The citation read as follows:

"Robert W. Angus, Professor Emeritus of Mechanical Engineering, University of Toronto; a member of the Association since 1917; recipient of the Fuller Award in 1942; distinguished as a teacher of engineering and as a leader among engineers, within and beyond the boundaries of the Dominion of Canada."

Lieut.-Col. W. E. Phillips, C.B.E., D.S.O., M.C., M.E.I.C., has been named chairman of the Board of Governors of the University of Toronto. As president of the government project, Research Enterprises Limited at Leaside, Ont., and director of various industrial, financial and mining corporations. Col. Phillips has rendered invaluable service to the war industry of Canada.

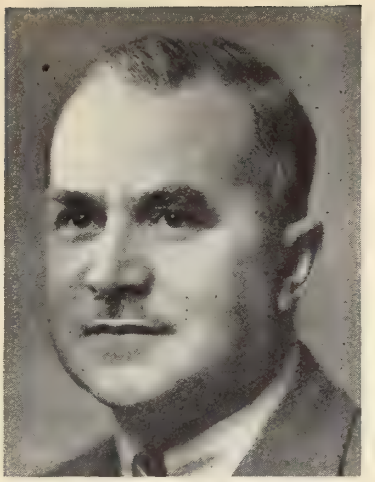
Ernest Lavigne, M.E.I.C.

Ernest Lavigne, M.E.I.C., has been appointed to the Council of the Institute to represent the Corporation of Professional Engineers of Quebec. Born in Quebec City, Que., he graduated in civil engineering from the Ecole Polytechnique in 1916. In 1918 Mr. Lavigne was employed as an assistant engineer with the Department of Public Works and Labour at Quebec and three years later went into private practice. Since 1926 he has held the position of Fire Commissioner of the Province of Quebec, at Quebec.

Mr. Lavigne joined the Institute as a Student in 1913, transferring to Junior in 1917. In the following year he transferred to Associate Member, becoming a Member in 1945.

Yvon De Guise, M.E.I.C., formerly senior engineer in the hydraulic service of the Department of Lands and Forests at Quebec, has been appointed assistant to M. V. Sauer, M.E.I.C., hydraulic engineer and general superintendent of generating stations, electrical department of the Quebec Hydro-Electric Commission at Montreal.

A graduate of the Ecole Polytechnique in 1937 and of the Canadian General Electric Company's Test Course in 1939, Mr. De Guise has also been lecturing at the Ecole Polytechnique since 1943 on hydraulic structures and elementary water-power engineering.



P. E. Poitras, M.E.I.C.

Paul-Emile Poitras, M.E.I.C., is the newly elected president of the Corporation of Professional Engineers of Quebec. Born at Mascouche, Que., he graduated from the Ecole Polytechnique, Montreal, in 1915. After being employed successively with the Inspection Board, the Dominion Bridge Company and the Canada Cement Company he joined the staff of the Steel Company of Canada Limited, Montreal, as an engineer in 1920. He later became mechanical engineer in charge of the engineering department, a position which he still holds.

Mr. Poitras joined the Institute as a Member in 1937 and for the past few years has been active in the affairs of the Montreal Branch, serving on the executive committee. Last year he was elected one of the councillors of the Institute for the Montreal Branch.

Albert Chartier, M.E.I.C., is now the Director of Industrial Training and Welfare, Plessisville Foundry, Plessisville, Que. His former position was that of Employment Officer and Industrial Mobilization Surveyor, Department of Labour, at Montreal

J. E. B. Cranswick, M.E.I.C., has recently been appointed manager of the Edmonton office of Canadian Westinghouse Co. Limited. He was formerly sales engineer.

Ralph Allingham, M.E.I.C., of White Plains, N.Y., was recently named general construction superintendent of the Wilputte Coke Oven Corporation of New York, N.Y. He had been with Semet-Solvay Engineering Corporation, New York, for the past eight years and was superintendent of construction at the time of his resignation.

E. V. Gage, M.E.I.C., has been appointed vice-president of the Institute for the province of Quebec to finish the term of office of E. B. Wardle who has resigned on account of ill health. Born at Pearceton, Que., Mr. Gage graduated from McGill University with the degree of B.Sc. in 1915. Upon graduation he joined the firm of the late A. F. Byers, M.E.I.C., engineer and contractor, and has been with the company ever since. On the death of Mr. Byers, a few years ago, Mr. Gage became president of A. F. Byers Construction Company Limited, Montreal.

Mr. Gage joined the Institute as a Student in 1914, becoming an Associate Member in 1919 and a Member in 1940. He has been active in the Montreal Branch for many years and in 1943 was elected a councillor of the Institute representing the Branch.

Col. I. Leonard, D.S.O., M.E.I.C.

H. G. Stead, M.E.I.C.

Col. H. A. McKay, O.B.E., M.E.I.C.

Colonel Ibbotson Leonard, D.S.O., M.E.I.C., who has been president and general manager of E. Leonard & Sons Limited of London, Ont., since 1923 will continue as a director in the firm which has been recently transferred from the Leonard family to a new company consisting largely of employees of the old firm. Col. Leonard is a graduate of the Royal Military College and McGill University and served with distinction during the first world war.

H. G. Stead, M.E.I.C., who has been with E. Leonard & Sons Limited since 1923, has been appointed president of the new firm. In 1937 he was appointed chief engineer and he will continue in that capacity in addition to his duties as president.

Colonel H. A. McKay, O.B.E., M.E.I.C., has been appointed vice-president of the new company and will assume the duties of general manager. He has recently completed four and one-half years active service with the Royal Canadian Engineers in the present war. Prior to this, he was manager of a steel fabricating company for several years.

L. F. Giauque, M.E.I.C., has severed his connection with the B. Greening Wire Co. Ltd., Hamilton, Ont., and is now employed by the Spruce Falls Power and Paper Co. Ltd., Kapuskasing, Ont., as mechanical engineer.

Lieut.-Col. W. S. Wilson, M.E.I.C., has been given command of the University of Toronto Contingent, Canadian Officers' Training Corps. Col. Wilson, who has been second-in-command for the past ten years and Officer Commanding the Second Battalion since its formation in 1940, succeeds Lieut.-Col. Madill who has just vacated the post. Col. Wilson holds the position of assistant dean and secretary of the Faculty of Applied Science and Engineering, University of Toronto. He is a councillor of the Institute.

Dr. W. C. Gussow, M.E.I.C., formerly employed by the Aluminum Company of Canada at Arvida, Que., is now with the Shell Oil Company as senior geologist for Eastern Canada and Newfoundland.

A. J. S. Taunton, D.S.O., M.E.I.C., formerly a group captain in the R.C.A.F., has been appointed to the Department of Veterans Affairs as welfare officer at M.D. 10, Winnipeg, Man.

Squadron Leader J. W. Lucas, M.E.I.C, has been released from the R.C.A.F, and has returned to the Testing Laboratories of the Department of Public Works at Ottawa where he was employed before his enlistment in 1941.

L. J. Ehly, M.E.I.C., has accepted a position in the pavement department, city engineer's office, City of Vancouver, B.C. He was previously with the Department of Transport of Canada at Lethbridge, Alta.

C. G. Carroll, M.E.I.C., formerly an officer in the Royal Canadian Air Force at R.C.A.F. Headquarters and Western Air Command Headquarters, has been made educational adviser of the Wartime Bureau of Technical Personnel at Ottawa, Ont.

C. J. Chaplin, M.E.I.C., who has held the position of timber mechanics officer in Forest Products Research (Department of Scientific and Industrial Research), England, for more than twenty years has resigned and will return to Canada shortly.

Squadron-Leader J. S. Motherwell, M.E.I.C., has been released from the R.C.A.F. and has accepted a position in the engineering department of the Powell River Company, Powell River, B.C.

J. E. Clark, M.E.I.C., who has been serving as a flight-lieutenant in the R.C.A.F. received his discharge in January and has returned to his former position of telephone engineer with the plant engineering department of the Bell Telephone Company at Kingston, Ont. While overseas, Mr. Clark was attached to the Royal Air Force on radar duties in England, Egypt, Cyprus and with the 8th Army in Tunisia, Sicily and Italy.

Major Jacques Déry, Jr.E.I.C., has recently returned to Montreal from Holland where he was fighting in the Second Survey Regiment. He has been overseas for five years and was wounded last summer in Normandy.

Lieutenant (E) A. Meade Wright, Jr.E.I.C., of *H.M.C.S. Prince David*, who returned home in February, has been mentioned in dispatches in recognition of service during the successful invasion of the south of France last August. Lieutenant Wright has been with combined operations since the landings in Sicily in 1943. In March he married Miss Joan Moon of Halifax, a daughter of Thomas Moon, M.E.I.C. He is now taking a special course in Washington, D.C. Lieutenant Wright is a son of Dr. L. Austin Wright, general secretary of the Institute.

Elect. Sub/Lieut. Harry C. Tilbury, Jr.E.I.C., has been appointed to the Directorate of Electrical Supplies, Naval Service Headquarters, Ottawa.

H. E. Blachford, Jr.E.I.C., formerly technical assistant of the Canadian Electrical Association, has been with the Inspection Board of United Kingdom and Canada for the past three years. He now holds the position of inspection officer on tanks at Montreal, Que.

Claude Bourgeois, Jr.E.I.C., is now employed as junior production engineer with Dominion Containers Limited in Montreal. He was previously with Canadian Celanese Limited at Drummondville, Que.

Robert W. Phillips, Jr.E.I.C., formerly an officer in the Canadian Navy, has recently been discharged and has returned to the Bailey Meter Company, Montreal, where he was previously employed.

F. C. Read, Jr.E.I.C., of Dominion Tar and Chemical Company Limited, has been transferred from Sydney, N.S., to the Toronto plant.

Elect. Sub/Lieut. M. M. Uloth, Jr.E.I.C., has been with the Directorate of Electrical Engineering, R.C.-N.V.R., for the past year and is at present on the electrical overseeing staff in Montreal. He was previously connected with the Canadian General Electric Company as junior engineer at Peterborough, Ont.

Arthur Ainlay, Jr.E.I.C., has recently accepted a position with Canadian Westinghouse Co. Ltd. at Hamilton, Ont. He was formerly technical assistant engineer with the Inspection Board of United Kingdom and Canada at Montreal.

Paul-Emile L'Heureux, Jr.E.I.C., who has been with the Department of Highways at Beauceville, Que., is at present employed in the engineering department of the City of Montreal.

Robert A. Kerr, Jr.E.I.C., is now a maintenance engineer in the cable division of the Northern Electric Co. Ltd. in Montreal. He was formerly with the Nichols Chemical Company as works engineer of the sulphuric acid plant at Valleyfield, Que.

Major John J. Denovan, S.E.I.C., overseas with the Canadian Technical Liaison group, has recently been promoted to his present rank. He graduated from Queen's University in 1940 with the degree of B.Sc. (Mech.).

A. C. Smith, S.E.I.C., recently left the staff of the Commonwealth Plywood Company, Ste. Therese, Que., to join Fred Mannix & Company Limited at Calgary, Alta.

Walter Arthur Runge, S.E.I.C., is now employed at Turbo Research Limited, Research Enterprises, at Leaside, Ont. He was formerly with Canadian Hanson and Van Winkle Co. Ltd. of Toronto.

C. Robert Matthews, S.E.I.C., who has been in the engineering department of the Wayagamack Division, Consolidated Paper Co. Ltd. at Three Rivers is at present working for Canadian Celanese Limited, Drummondville, Que., as a junior engineer.

Donald C. McWhirter, S.E.I.C., is now employed by the Goodyear Tire & Rubber Company at New Toronto, Ont., as a development and production engineer.

Obituaries

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

Raymond Stirling Kelsch, M.E.I.C.

Raymond Stirling Kelsch, M.E.I.C., a pioneer in the development of the telephone and electric lighting, died at his home in Montreal, Que., on February 4th, 1945. Born at Chicago, Ill., on May 19th, 1862, he attended the Armour Institute of Technology.

After working a short time as telegraph operator he joined the American District Telegraph Company as manager of their main office in Chicago. In 1891 he was transferred to the American District Telephone Company's main office as manager. In the same year when the American District Telephone Company and the Bell Telephone Company consolidated to form the Chicago Telephone Company he was made division superintendent. In 1885 Mr. Kelsch resigned to join the Chicago Arc Light & Power Company as superintendent of their southern district and three years later was made general superintendent and chief engineer of the company. In 1892 the company was bought by the Chicago Edison Company and Mr. Kelsch remained with the reorganized Edison company for the next five years. He resigned as superintendent of high tension power houses, underground systems and shops to come to Canada. In 1897 he accepted the position of general superintendent and chief engineer of the Lachine Rapids Hydraulic and Land Company at Montreal. He supervised the erection and operation of their hydro-electric power house and distributing light and power system. When the company was purchased in 1903 by the Royal Electric Company, the original Montreal Light and Power Company, Mr. Kelsch resigned and opened an office as consulting engineer. He was immediately retained as consulting engineer of the Royal Electric Company by its president, H. S. Holt, who later became Sir Herbert Holt, to consolidate the several plants and properties of the company with the Lachine Rapids and Land Company. This later became the Montreal Light, Heat and Power Consolidated. He was retained permanently by that company since that date until his death.

Since its inception in 1911 he had been a commissioner of the Electric Service Commission of Montreal, being appointed to represent the various utilities that used the municipal conduit system. He pioneered in the design of steam and hydro-electric properties and had installed plants in many parts of Canada. In 1906 he promoted and directed in Montreal the largest electrical exhibition ever held in Canada. He invented the white background for curling rink ice as well as a number of electrical devices. He retired in 1926 but was retained by several light, power and industrial companies in a consulting capacity until the time of his death.

Mr. Kelsch joined the Institute as a Member in 1908. He served as a councillor from 1908 until 1910.

Group Captain David Gabb Williams, M.E.I.C., was killed on November 23rd, 1944, when the aircraft of which he was a passenger crashed near Calgary, Alta.

Born in England on October 28th, 1911, he received his education in Edmonton, graduating from the University of Alberta with the degrees of B.Sc. and M.Sc. in electrical engineering in 1933 and 1935 respectively. Since 1935 he had been an officer in the Royal Canadian Air Force. He served as Signals Officer with the Western Air Command at Vancouver and during the past few years had been stationed at various other points throughout Canada. He was transferred to Calgary in the summer of 1944.

Group Captain Williams joined the Institute as a Student in 1933, transferring to Associate Member in 1940 and becoming a Member in the same year.

Harry Cleophas Brown, M.E.I.C., died after a short illness in Toronto, Ont., on February 21st, 1945. Born at Amherst, N.S., on July 2nd, 1890, he attended St. Francis Xavier University and McGill University from where he graduated in 1917 with the degree of B.Sc.

Following graduation he enlisted with the Canadian Engineers and served in France with that unit. On his return from overseas he was engaged on electrical power design with the Hydro-Electric Power Commission of Ontario and in 1920 was employed by the Wayagamack Pulp and Paper Company on electrical sub-station and mill design. From 1921 until 1923 he was with the Belgo Canadian Pulp and Paper Company as electrical engineer in charge of design, construction and operation. For the two years following he was employed at Cornerbrook, Nfld., by the Newfoundland Power and Paper Company as electrical engineer responsible for design and purchase of equipment for the new substation and paper mill. He was also in charge of electrical construction of the same plant for Sir W. G. Armstrong Whitworth Co., general contractors. During 1924-25 he held this dual position, working with each of the above companies. From 1925 until 1928 he was in charge of the Hydro-Electric Power Station at Deer Lake, Nfld., and also had under his jurisdiction all transmission lines and electrical maintenance and operation at the large paper mill at Cornerbrook. In 1929 Mr. Brown joined the staff of the manufacturing department of the International Paper Company in New York, N.Y., and in the following year was made chief electrical engineer with the company. During the preparation for the World's Fair held in 1939 and 1940 he was connected with the engineering division of the World's Fair Inc. at New York. In 1941 he went with the Union Bag and Paper Corporation at Savannah, Georgia, and two years later was employed by the Crossett Paper Mills, Crossett, Arkansas, with which firm he was associated at the time of his death. He was in charge of post-war planning.

Mr. Brown joined the Institute as an Associate Member in 1925 becoming a Member in 1940.

Harry Ernest Huestis, M.E.I.C., died in Quebec City on February 8th, 1945, after a brief illness. Born at Grand Pré, N.S., on January 31st, 1873, he attended Mount Allison University, Sackville, N.B., and later attended McGill University, Montreal, from where he graduated with the degree of B.A.Sc. in civil engineering in 1896. For several years after graduation he was engaged as an engineer on railway construction. In 1919 he was employed by the Bedford Construction Company at St. John, N.B., and in 1923 became associated with the Quebec Harbour Commissioners at Quebec City. He remained with this harbour until the time of his death when he held the positions of chief engineer and assistant general manager.

Mr. Huestis joined the Institute as an Associate Member in 1905 becoming a Member in 1940.

James Macdonald Gilchrist, M.E.I.C., died at Montreal on February 20th, 1945. Born at Cambridge, N.B., on December 21st, 1879, he received his preliminary education at Cambridge. At 18 years of age he joined the Canadian Army and served as a corporal with the Second Contingent in South Africa. On his return from the Boer War he entered the University of New Brunswick graduating in 1908 with the degree of B.Sc. in civil engineering. He later received his C.E. For the next few years he practised as an engineer chiefly in Quebec and Northern Ontario.

During the first world war he served as a lieutenant in the R.N.V.R. For three years he was in command of a sub-chaser in the North Sea and took part in the raid on Zeebrugge. When trouble arose in Egypt he was transferred there. He was placed in command at Port Said taking part in the policing of the Suez Canal and participating on behalf of the British Forces during the strike in Egypt. In 1919 he returned to Canada and for several years worked on various construction projects in Quebec and Northern Ontario. During the present war he was engaged on construction of air bases in Quebec and Newfoundland.

Mr. Gilchrist joined the Institute as a Student in 1908, becoming an Associate Member in 1914 and a Member in 1940.

John Robert Rostron, M.E.I.C., died at his home in London, Ont., on November 12th, 1944. Born in Stockport, England, on December 13th, 1867, he received his preliminary education there, later attending Victoria University at Manchester and the Manchester Technical College. From 1883 until he came to Canada 30 years later he was employed in engineering work, connected principally with railways. He joined the staff of the city engineer's department in London, Ont., in 1915 and remained a valued member of that staff until his retirement in 1937. Many fine bridges in the city of London stand as monuments to his professional ability.

Mr. Rostron joined the Institute as an Associate Member in 1921 becoming a Life Member in 1937. He was a charter member of the London Branch at the time of its inauguration in 1921 and served as chairman in 1926 as well as a member of the executive committee for several years.

2nd/Lieutenant René Edmond Brandt, S.E.I.C., died at Kingston, Ont., on December 10th, 1944. Born at Pointe aux Trembles, Que., on May 31st, 1923, he attended McGill University graduating with the degree of B.Eng. (Mech.) in 1944. Upon graduation he enlisted in the Corps of the Royal Canadian Electrical and Mechanical Engineers.

Lieutenant Brandt joined the Institute as a Student in 1943.

News of the Branches

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

HAMILTON BRANCH

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

On Thursday, February 22nd, the regular monthly meeting of the Hamilton Branch was held in the Science Lecture Room, McMaster University. Forty-eight members and guests were in attendance.

L. C. Sentance introduced the speaker of the evening, Mr. H. Little, vice-president and sales manager of R. & M. Bearings, Canada, Ltd. Mr. Little chose as his topic **Ball Bearings.**

Mr. Little dealt at some length with the development of bearings, from the first crude wooden roller to the present day high precision anti-friction bearings. On the North American continent metric sized bearings are used almost exclusively and the dimensions of these bearings have been effectively standardized by the Annular Bearing Engineers' Committee. No such standardization, however, has been accomplished with regard to load ratings of anti-friction bearings and nearly all manufacturers base catalogue ratings on different life factors. Mr. Little demonstrated, however, that even after having reduced the catalogue ratings to a common life expectancy, allowable loading as designated by various manufacturers were found to vary by more than 100 per cent.

Mr. Little's remarks served as introduction for two sound films, produced by the New Departure Division, General Motors Corporation. These films were entitled **The Manufacture of Ball Bearings** and **Micro Instrument Bearings, Their Care and Handling.** These films depicted the various manufacturing operations attendant upon quantity production of modern ball bearings. The second film in particular stressed the great length to which the manufacturer had gone in order to ensure dimensional accuracy and cleanliness. Such care as exercised by the manufacturer forcibly pointed out to the users of such bearings the necessity for equally strict control of conditions attending the handling and mounting of such bearings in the users' equipment.

Subsequent to the showing of these films, Mr. Little answered numerous questions.

The meeting adjourned at 10 p.m. for the customary refreshments.

LAKEHEAD BRANCH

J. I. Carmichael, M.E.I.C. - *Secretary-Treasurer*
R. B. Chandler, M.E.I.C. - *Branch News Editor*

On February 12th at the regular monthly dinner meeting members of the Lakehead Branch were addressed by Mr. E. M. Proctor of James Proctor & Redfern, consulting engineers, Toronto, on the subject of **Modern Municipal Sanitation.**

Members of the City Councils of Fort William and Port Arthur were guests at the function. S. T. McCavour, chairman of the Branch, presided.

Introduced by S. E. Flook, city engineer of Port Arthur, the speaker dealt with his subject under four divisions,—Water Supply; Sewage Disposal; Garbage Collection and Disposal; and Street Cleaning.

In his remarks on Water Supply Mr. Proctor said that water, as a solution of oxygen, salts, etc., causes trouble for the sanitary engineer. The important part of that solution was oxygen. At 39 degrees Fahrenheit water reaches its heaviest state. In a lake it reaches this temperature twice a year, in the spring and in the fall. When this occurs, the heavy water on top sinks to the bottom transposing the water on the bottom to the top, thus keeping the lake fresh.

This creates a problem for sanitary engineers as the transposition churns the bottom of the lake, causing trouble in a city's water supply. Mr. Proctor pointed out that movement in northern lakes is a boon in comparison to lakes of the southern states, which frequently become stagnant because equal temperatures prevent a changeover.

"Lake Superior is perhaps one of the most ideal lakes for hardness of water," he said. "The hardness maintains at 80 degrees and water is clear and cold. If it was any softer it would not be very palatable. Lake Huron registers 100, Lake Erie over 100 and Lake Ontario about 120."

The nearer the water gets to the seaboard the harder it becomes, taking on salts from the surrounding watersheds. Salt and alkali cause trouble to piping in modern sanitation. Therefore chemicals are added to remove same.

Odorous waters are counteracted with the addition of chlorine, which kills off the gas-forming particles causing the odour. A peculiar point of chlorination, the speaker asserted, was that while it kills off the odour it remains tasteless in the water.

Typhoid fever, he said, is almost unknown in modern cities. The disease, a scourge in the old days, is almost non-existent now. The disease of goitre, which was water borne, has been greatly alleviated with iodized salt.

The sewage disposal plant removes suspended solids by screening. The effluent is discharged to large bodies of water where dilution enables the oxygen in the water to further clarify it. "Unless you get back the oxygen in the water you have an unstable problem," he said. This was determined by the B.O.D. method, the biochemical oxygen demand.

In the sludge digester, the sludge is cooked to speed the bacterial reaction. "Nature does not take the sludge out of your lakes," Mr. Proctor maintained. "When sewage is dumped into your lakes it must settle somewhere and every day of the year that it is running down your river into the lake it is collecting."

In disposing of sludge, some municipalities take it out in the open and let it dry in sludge beds. Some place glass over them and dry it quicker. The modern method, he said, is to take the sludge to the incinerator to burn it. Frequently the dried-out sludge is used as fertilizer on the city's boulevards or sold to farmers.

Modern incinerators burn all the municipality's garbage without using fuel. In Toronto no coal or oil was used. A law making residents wrap garbage in paper was the reason.

A series of slides showing mechanical equipment and charts in connection with municipal sanitation were shown.

The speaker was tendered a vote of thanks by Walter H. Small. Mayor C. W. Cox, Port Arthur, and

Acting Mayor Hubert Badanai, Fort William, welcomed Mr. Proctor to the Lakehead.

R. B. Chandler, councillor of the Institute, gave a resumé of the Annual Meeting at Winnipeg which was attended by six Lakehead Branch members.

LETHBRIDGE BRANCH

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

A very interesting and informative address was delivered to the local branch of the Institute, February 23rd, by Mr. D. D. Morris, general superintendent of the Alberta Nitrogen Products Limited. Because of the nature of the industry a description in general terms only could be given.

The plant commonly called the Ammonia Plant, actually consists of four operating plants: the gas production plant, the ammonia plant, the nitric acid plant and the nitrate plant.

The gas production plant produces purified hydrogen and nitrogen. The hydrogen is obtained from the reaction of natural gas and steam while the nitrogen is obtained from the air by burning out the oxygen with natural gas.

The ammonia plant is the largest and most important on the site. It divides itself naturally into five main sections, namely: compression section, CO^2 purification section, CO purification and Cu liquor regeneration section, synthesis section and the refrigeration section. In the compression section are located five of the largest compressors on the North American continent, being six stage and each driven by a 2500 Hp. synchronous motor producing pressures up to 5200 lbs. per sq. in.

The nitric acid plant produces nitric acid from the reaction of ammonia with air and water passing over a suitable catalyst. Unfortunately a secondary reaction takes place which cuts down the production of HNO^3. This complicates the procedure necessitating the close control of reaction conditions. The corrosive nature of the product makes necessary the use of stainless steel for most of the equipment.

The ammonia nitrate plant consists of three main sections: neutralization and concentration section, crystallization section and drying and packing section. from the reaction $HNO^3 + NH^3 = NH^4\ NO^3$, heat is produced. This heat is used in many ways throughout the plant. Practically all of this product now goes into the manufacture of fertilizer.

It is interesting to note the amount of power and materials used at this plant in comparison with the city of Calgary. Electrical power consumption is equal to approximately 115 per cent of that of the city. Natural gas about 30 per cent on a year round basis and water approximately 150 per cent. The amount of chlorine used daily is equal to that used by the city of Montreal.

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. - - - }

On Thursday evening March 1, Mr. W. J. Davidson, director of engineering of General Motors Corporation, gave a lively and fascinating talk to the Montreal branch on some of the services rendered by the Motor Industry in War.

The speaker told the audience that he was in France when the Germans invaded that country, and that his observations led him to believe that France fell, not because of treachery or sabotage, but rather because of "bad national management over a period of years" which allowed the country's war equipment to become "scandalous". He then described the effects of German air power during that period, and spoke of the problems involved in the compilation of the first lend-lease orders.

In early 1941 he was recalled to the United States to head the Automotive Ordnance Section of G.M.C., the department that designs and develops war equipment for the United Nations. The most pressing problems of the time, he said, were what to build, how many units of each, delivered when and where. Because of the urgency of the situation it was decided to adapt commercial motor products for war vehicles instead of designing and building special-purpose units. This did not give the best possible product, but it did give good units in immense quantities. Mr. Davidson then went on to explain how diesel engines designed for locomotives were successfully used in trucks, tanks, landing ships and amphibious craft.

The war materials produced by the automotive industries are used in every land, sea and air battle. Mr. Davidson related incidents and revealed many interesting features of the General Sherman tanks, the new United States super battleships, the British floating wharfs, the landing craft and the ducks ("trucks that float").

In concluding his address, Mr. Davidson paid tribute to the 300 manufacturers' representatives who went into the field to teach the service men how to handle and maintain their new war machinery, and who collected invaluable data for use in new designs. He appealed for continued research so that our technical superiority over the enemy would be maintained in the post-war era.

An Army-Navy film showing the dramatic sea battle that occurred during the landings on Leyte followed the address.

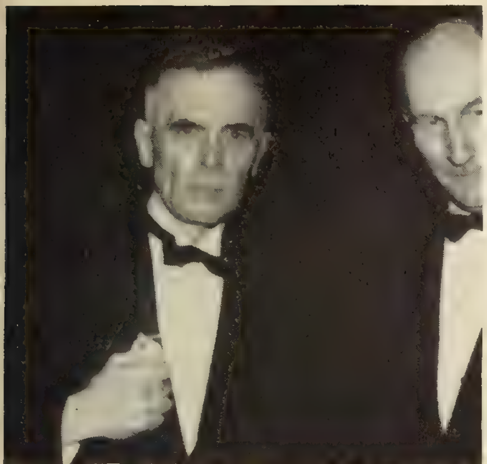
I. I. Sylvester thanked the speaker. R. E. Heartz presided at the meeting.

Four hundred persons assembled at a banquet held in the Mount Royal Hotel, on February 22nd, 1945, in honour of General A. G. L. McNaughton, C.B., C.M.G., D.S.O., M.E.I.C., Minister of National Defence.

After the dinner the chairman of the meeting, John B. Stirling, called upon Dr. Fairbairn who, with a few very appropriate compliments, introduced the General as the speaker of the evening.

In opening his address General McNaughton recalled to the members the previous occasion that he had spoken to them. It was during a dangerous period in the history of Canada and the democratic nations. The Battle of Britain was drawing near to its victorious ending and the Canadian Army was standing guard against an invasion which the Germans never dared attempt. Even while this was happening plans were being formulated for our invasion of the continent of Europe. The United Kingdom was to be the spring board for the attack. It was decided then to keep the loss of life at a minimum by expending any amount of material required to gain the objective. Such an invasion therefore required armour, mechanical vehicles, more powerful explosives, weapons of greater accuracy, airplanes, ships, landing craft, optical instruments, communication equipment and immense quantities of other kinds of materials; but

MONTREAL BRANCH SOCIAL EVENING



General the Honourable A. G. L. McNaughton, M.E.I.C., the guest speaker, is seen here with J. B. Stirling, chairman of the branch.

(Right) Past-President J. M. R. Fairbairn introduces the guest speaker.

(Below) At the head table, from left to right: Mrs. McNaughton, Lt.-Col. C. C. Lindsay, Lt.-Col. T. D. K. Rooney, D.E.O., M.D. 4, Mme. J. A. Beauchemin, J. E. Armstrong.

Mrs. J. M. R. Fairbairn, Past-President A. J. Grant, Beaudry Leman, M.E.I.C., president of the Banque Canadienne Nationale who asserts that he is " an engineer who has gone wrong ".

J. A. Lalonde tells Mrs. Rooney about co-operation in the engineering profession.

From left to right: W. G. M. Shepherd, Mrs. S. Rutherford, W. S. Lea, Mrs. G. Rutherford.

" Et voilà pourquoi votre fille est muette "! L. P. Cousineau explains to the young lady.

above all, an army well-trained in the techniques of modern warfare.

Fortunately, in this country most raw materials required for war purposes were to be had for the seeking, the speaker stated. In addition there were many skilled engineers and industrial leaders with pioneering instincts who were ready to serve. In order to co-ordinate Canada's productive capacity with that of the British and Allied Nations, General McNaughton returned to Canada.

In reviewing the successful events since D-day the General stated that the scientists, doctors and engineers of Canada gave " a most effective help . . . . and made great contributions to the War Effort." The records he saw as Commanding Officer of Canada's Army and as Minister of Defense verify this. Some of the items he mentioned were Canadian developed and Canadian mass-produced time fuses, armour piercing shells, tungsten carbides for tools, techniques for air-field construction, optical and radio devices, and tropical proof packaging paper. In the chemical field we have explosives, gases, flame throwers, also new drugs to combat the sufferings of the wounded. There are many more developments which must still be kept secret.

The General spoke briefly of the great service rendered by the National Research Council. He pointed out that experiments on the Cathode Ray Compass, Ionosphere, radar and optical glass were conducted in the Councils laboratories as early as 1938. A very efficient method for the extraction of magnesium was developed here. The National Research Council is a small organization but it is a nucleus on which scientists and engineers can base their efforts.

As Minister of National Defence, General McNaughton expressed the thanks of the Service Men to the engineers and industrialists for the " newest and best equipment in the world." " The Army is not denied anything," he concluded. " It is fully reinforced. It will be fully maintained."

Mr. de Gaspé Beaubien in thanking the speaker spoke in French, and then in English as follows:

" General, we thank you for coming to us; for your very inspiring address; for having carried so high the ideals of the profession.

" But there is something for which we may not have the authority to thank you, and something for which we have in our hearts a very warm feeling of gratitude towards you, that is, the care you have taken of our boys and for the pains you have taken to make and mould a Canadian Army. Your efforts have been tireless through the drudgery of long years of training, facing always the uncertainty of if and when that enormous effort could bear fruit. We now can judge your far-sightedness. We now see, by the success of our troops, how thoroughly that training was done. And for that, General, we hold a very warm place in our hearts for you."

An excellent musical performance by the Rotary Club Review, a group of twenty-five talented amateur players, rounded out this social evening.

OTTAWA BRANCH

C. G. Biesanthal, Jr.E.I.C. - *Secretary-Treasurer*
R. C. Purser, M.E.I.C. - - *Branch News Editor*

A joint meeting of the Ottawa sub-section of the American Institute of Electrical Engineers with the Ottawa Branch of The Engineering Institute of Canada, was held at the auditorium of the National Research Council, Sussex Street, on the evening of Tuesday, February 20. The speaker was J. L. McKeever, general engineer, Peterborough Works, Canadian General Electric Company, who gave a technical lecture on the Amplidyn Machine.

Mr. McKeever pointed out that the device has found extensive application in the control of turrets on aircraft and warships, and is being used for various peacetime services, such as in the control of paper and steel mills, electric arc furnaces, and mine hoists. It ensures better control, conserves manpower and materials and speeds production.

" The aim of all electrical engineers," said Mr. McKeever, " is better control of electrical energy, making such control easier, faster and more accurate. This machine is a major step in that direction."

The speaker was introduced by B. G. Ballard, chairman of the local section of the American Institute, and was thanked by Norman Marr, chairman of the Ottawa Branch of the Engineering Institute.

A new idea in the history of the Ottawa Branch was carried out at a noon luncheon meeting at the Chateau Laurier on March 8th. This was the presentation of a report on the Winnipeg annual meeting by W. L. Saunders, who attended as the Branch's special representative. Mr. Saunders is a past-chairman of the Ottawa Branch and is at present councillor to the Institute.

Mr. Saunders gave a complete report of the activities at the meeting, with brief comments upon the papers and addresses presented, as well as other features of the programme. He included a personal touch to his account by referring to a portion of his trip west which was made by motor car from Kenora to Winnipeg. On this section he visited a part of Manitoba east of Winnipeg that he used to ride over on horseback and cover on foot 38 years ago during the construction of the Transcontinental Railway. At that time it was being freshly settled by newly arrived immigrants from different parts of Europe and the country was being opened up by means of corduroy roads, the settlers using oxen entirely for draft purposes.

" To-day these same settlers and their children are living in well built homes on farms that are largely cleared of bush, using all modern equipment, including horses and motor vehicles," said Mr. Saunders. " I later found on arriving in Winnipeg that the children of many of these immigrants having received their primary education in the little log school houses, had now graduated from University and were taking their part in the development of the west."

Mr. Saunders made special reference to the outstanding contribution toward the success of the annual meeting by the Engineers' Wives Association of Winnipeg. He also spoke of the many activities in Winnipeg of this organization in connection with the war effort and commended the idea of a similar organization for other branches.

PETERBOROUGH BRANCH

Eric Whiteley, Jr.E.I.C. - *Secretary-Treasurer*
J. F. Osborn, Jr.E.I.C. - - *Branch News Editor*

The March 1st meeting of the Peterborough Branch was addressed by A. C. Northover, whose paper **The Design of a City** dealt comprehensively with the technical basis of city planning.

The speaker elaborated on the various studies carried out by city planners in analyzing and solving a community's practical problem and in making provision for its evolution along orderly and efficient lines. The scope of the paper included: street layout with traffic capacity and pavement width studies embracing volume and density traffic surveys, origin and destination counts and cordon counts. Mass transit studies were analyzed and the design of transit service was discussed. The pure city planning study, including the land area use map, neighbourhood unit, playgrounds, utility services, was thoroughly developed. The master plan was described and illustrated.

The data accumulated by planners is translated into a master plan or map for convenience. The plan should include information on:

- Future through streets
- Parking areas
- The routing of through traffic
- Future transit route designed to expand or retard local growth
- Subway or expressway recommendations

The results of the analysis of present facilities and future facilities to serve present growth and to encourage or retard future growth both residential and industrial

- The expense of removal of blighted areas
- Future recreational centres
- Investigation of results of commercial decentralization
- Group housing sites
- Proper siting of buildings
- Utility service extension

The speaker demonstrated that growth of a city by random, unco-ordinated development leads to blighted areas, congestion and ultimate losses of great magnitude when the time comes that past mistakes have to be corrected. The engineer's role in the post-war future was emphasized. The responsibility of slum clearance and improved urban living conditions lies not only with capital and labour but also, more than ever before, with the engineer, who in his intermediate position has been far too lax and disinterested in the social results and effects of his creations.

In conclusion, Mr. Northover suggested that the design basis of a city is highly technical and, therefore, those best fitted to alter the city are not doctors, lawyers, and business men, but the men who have the knowledge to make and carry out a satisfactory design.

There was present a number of representatives from the Peterborough City Planning Committee, of which Mr. Northover is a member, as well as a number of other guests. A lively discussion period followed the paper, and the general opinion seemed to be that a systematic appraisal of the problems facing the city of Peterborough should be made as soon as possible.

SAINT JOHN BRANCH

L. O. Cass, M.E.I.C. - - *Secretary-Treasurer*
G. W. Griffin, M.E.I.C. - *Branch News Editor.*

Man's quest through the ages to discover means of reducing friction between moving bodies and his realization that " nothing rolls like a ball " was outlined by Mr. Harry M. Little of R. & M. Bearings (Canada) Ltd., before a supper meeting of the Branch on March 8th.

Fifty members were present at the meeting which was held in the Admiral Beatty Hotel. C. D. McAllister, branch chairman, presided.

After his review of anti-friction measures down the ages, Mr. Little dealt with the manufacture of ball bearings supported by moving pictures showing all phases from the arrival of the raw material at the plant to the finished bearing. A second film showed the making and care necessary in handling ball bearings for micro instruments such as aircraft instruments, bombsights, autosyn motors, etc.

Both films were produced by the New Departure Division of General Motors Corporation of America.

The chairman announced that the Branch would have as guests at its April meeting, President E. P. Fetherstonhaugh and party.

TORONTO BRANCH

S. H. de Jong, M.E.I.C. - - *Secretary-Treasurer*
G. L. White, Affil. E.I.C. - - *Branch News Editor*

The Annual Student Night of the Toronto Branch was held in the Debates Room, Hart House, on February 15th. The Engineering Institute prize at the University of Toronto for 1945 was presented to Mr. Wermer Buchholz by H. E. Brandon, Hydro-Electric Power Commission of Ontario. The three speakers, their addresses, and the prizes which they won were as follows:

H. H. Todgham—" Continuously Moving Forms " —First Prize.

D. E. Becks—" Cavitation of Marine Propellers "—Second Prize.

R. T. Cavanagh—" Metallurgical Testing by Electronic Means "—Third Prize.

The Judges were: A. H. Hull, C. E. Hawke and R. F. Moore, president of the Engineering Society, University of Toronto.

At the meeting held in Hart House on March 1st the members of the Toronto Branch heard an interesting address by Arthur J. Boase on reinforced concrete design in South America. .

The speaker, who was introduced by J. M. Breen, is manager of the Structural Bureau, Portland Cement Association. Last summer, while on leave as special editorial representative of the *Engineering News-Record,* he spent three months in Brazil, Argentina and Uruguay.

In the Brazilian cities, particularly Rio de Janeiro and Sao Paulo, building was found to be very active and characterized by the construction of numerous large reinforced concrete office and apartment buildings, many of them of great height.

At Buenos Aires in the Argentine, building rivals that in Brazil, while in Montevideo, Uruguay, it is active, but on a smaller scale than elsewhere. At present Argentina is engaged in a vast military expansion programme.

In all the cities visited reinforced concrete was the only material being used on the projects seen under construction. Careful enquiry indicated that this has been true for many years owing primarily to the shortage of structural steel. There is a scarcity of all building materials and a shortage of labour and of designing engineers. Transportation is entirely inadequate, there being a shortage of roads and of shipping. Fuel is very scarce.

There are other reasons for the exclusive use of reinforced concrete. The first firms of designers and constructors in South America were German, Italian and French. These engineers had developed their design theories and had applied them widely in their own countries long before the use of concrete had become general in the Western hemisphere. These firms were equipped both to design and construct and were able to supply very economical buildings. There are now also many firms of independent architects and engineers active in securing commissions, which helps to stimulate economy.

The reinforced concrete codes are favourable to the use of reinforced concrete. They permit many things unheard of in United States practice though the unit stresses and specified design loads do not differ greatly from those used here.

The fact that reinforced concrete is an economical type of construction in South America does not mean that it is cheap. Material costs are high and labour, though cheap, is inefficient. Concrete costs about $40 per cu. yd. in Brazil, the materials costing 80 per cent and the labour 20 per cent.

The engineering colleges are relatively small, and few in number. The laboratory courses, if any, are very limited and draughting room work is held to a minimum. This means that much time is devoted to intensive training in mathematics and mechanics. Generally from five to six years are required for graduation. The graduates generally have a good command of foreign languages, particularly French, German and English. They are able mathematicians and are quite conversant with the latest theories of structural design.

The combination of modern theory and generous building codes results in light construction. Light floor systems using 1 and 2-way slabs with and without filler tile are commonly used. Thin shell roof construction is in common use, especially in Argentina. The pre-stressing of reinforcing steel is just starting and the process is being thoroughly studied.

The address was illustrated by slides showing examples of ingenious construction. After Mr. Boase had answered many questions, which were evidence of the interest aroused by his able presentation, a very hearty vote of thanks was moved by R. B. Young.

VANCOUVER BRANCH

J. G. D'Aoust, M.E.I.C. - *Secretary-Treasurer*
P. B. Stroyan, M.E.I.C. - *Branch News Editor*

On Thursday, February 22nd, about fifty members including ten student members of the Vancouver Branch met in the auditorium of the Medical Dental Building for the Annual Students' Night.

A. Peebles, chairman of the Vancouver Branch, welcomed the members and students and introduced Harold Graves, S.E.I.C., President of Student Chapter of the Institute at the University of British Columbia. Mr. Graves took charge of the meeting and presented the speakers in turn.

W. G. Grimble, S.E.I.C., addressed the meeting, taking as his subject **Landing Floats for Pleasure Craft** and dealt very capably with the advantages and disadvantages of the different types of float anchorages commonly used in the Pacific coast tidal waters. Details of construction, comparative costs and other interesting items showed the speaker's knowledge of his subject.

The second speaker was F. E. Turley, S.E.I.C., whose subject was **Contracting and the Young Engineer.** Mr. Turley developed his theme logically, commenting on the different ways of entering the contracting business, and more particularly on the art of staying in business. The principles underlying the scientific preparation of estimates were laid down, with the rather philosophic observation that, in spite of all these principles, the successful bidder was usually the one who had left out one of the larger items thus attaining the doubtful honour of being hailed as the lowest bidder. The speaker then explained in detail how to organize a job so as to come out with a profit—

" Out of the mouths - - "

The third and last address was given by D. A. Fraser, S.E.I.C., speaking on **Replacement Derrick Landing Wharf at Esquimalt,** a structure involving the placing of concrete in deep water by the open caisson method. Details of the methods of placing sub-aqueous concrete indicated the obvious advantages of the tremie pipe for such work. The design and construction of the caissons brought out many interesting features of the job, as did the description, illustrated by blackboard sketches, of the main features of the job.

C. E. Webb, past Councillor for the Branch, complimented the speakers on their able presentations of the subjects and congratulated the Student Chapter of the University of British Columbia on the large and active membership.

WINNIPEG BRANCH

A. T. McCormick, M.E.I.C. - *Secretary-Treasurer*
V. W. Dick, M.E.I.C. - - *Branch News Editor*

The annual meeting of the Winnipeg Branch, postponed from February 8th on account of the Fifty-ninth Annual Meeting of the E.I.C. held in Winnipeg, was held on February 15th, 1945, at the University of Manitoba.

The retiring chairman of the Winnipeg Branch, T. H. Kirby, pointed out the highlights of the past year that culminated in the Annual General and Professional Meeting of the Institute and the appointment of Dean E. P. Fetherstonhaugh as president of the Institute.

F. V. Seibert, chairman of the Winnipeg Annual Meeting Committee, gave an interim report on the Annual Meeting indicating an outstanding success on all counts.

A feature of the evening was the presentation of the Engineering Institute student prizes donated by the Winnipeg Branch for the best summer thesis submitted in the electrical and civil engineering fields. Branch Councillor H. L. Briggs made the presentation, the electrical award going to E. M. Scott, for his thesis on " Operation and Construction of a modern Oil Circuit Breaker ". The Civil award was won by W. C. Porter for his thesis on " Description of Seismic Exploration ".

Two films were then shown **Making and Shaping of Steel** by the United States Steel Company, and **The Canol Oil Project** by the United States Army Public Relations Branch, after which the meeting adjourned.

On Thursday, March 1st, a joint general meeting of the Winnipeg Branch of the Institute and the A.P.E.M. was held in theatre " F " at the University of Manitoba, Broadway. The chairman was Lt.-Col. Geo. E. Cole, who introduced the speaker, W. D. Hurst, city engineer and commissioner of buildings.

The subject of the address was **The Organization**

and Work of the City of Winnipeg Engineering Department, which covered the history of the engineering department from 1874 to the present day, indicating the progressive enlarging of the department with its various responsibilities and duties.

In 1924 the following separate departments were amalgamated with the engineering department and placed under the city engineer: water works operating, plumbing and sewer, machine shop, building inspection, and quarries. In 1926 the duties of the department of street commissioner were divided, the city engineer being made responsible for sprinkling and oiling of streets, removal of snow and ice, sanding of sidewalks, and investigation of claims against the city in connection with accidents on the streets.

Details of the present organization were then given under the following headings: (1) executive, (2) clerical and accounting, (3) water works and sewerage, (4) roads and streets, (5) inspections, (6) design, (7) shops. The chief executive officers are the city engineer, and the deputy city engineer, and Mr. Hurst indicated that an executive assistant engineer would be required in the near future.

Some interesting facts and figures were given for the various departments, one of these being the city quarry comprising 27 acres of first-class limestone rock, the area of the property being 107 acres. The yearly production has been as high as 69,000 yards and has averaged 12,000 cu. yds. for the past ten years. The city gravel pit at Bird's Hill consists of 61 acres of first-class gravel and sand. The average yearly production for the past ten years has been 22,000 yards with a peak of 37,000 yards in 1930.

The central mixing plant on Ross Avenue provides the cement concrete used by the city. The average yearly production for the last ten years has been 10,000 yards, with a maximum production of 41,000 yards in 1931. The municipal asphalt plant which was the first city-owned plant in America, produces binder and surface asphaltic mixtures, the average production being 11,350 tons per year for the last ten years.

In the past the city's construction organization has bid as an agent of the city in competition with private firms, but in recent years it has had no real competition on street and lane pavements, and in a lesser degree with sewers and watermains, and this work has been delegated to the department without calling for tenders. The total value of local improvements carried out in 1944 amounted to $430,912.

Interesting details of duties involved in the divisions of inspection and design were given, probably the most arduous job being that of Engineer of Inspections who is responsible for seeing that buildings are constructed and maintained to the standard set by the building and plumbing by-laws. Details of city operated shops were also given, the most important being the machine shop, electric and gas welding shop, blacksmith shop, carpenter shop, paint shop, garage and tools and plant storage buildings.

Mr. Hurst brought his address to a close by describing the new incinerator plant for the city, which is in the design stage and is expected to be completed by the end of 1946 or shortly afterwards. Illustrations of various designs of incinerators were shown on the screen and proved of great interest. A lively discussion followed after which a vote of thanks to the speaker closed the meeting.

Student Section

Reported by D. G. Maxwell, M.E.I.C.

At a luncheon gathering of the engineering students on January 22nd, Professor Milton S. Osborne of the Department of Architecture of the University of Manitoba, gave a very enlightening and stimulating talk on **Town Planning.** Professor Osborne has had a great deal of experience in this work in the cities of Chicago and New York, and as Special Projects Planner of the Metropolitan Town Planning Commission for Greater Winnipeg.

The highlights of the address centred around the post-war plans for Winnipeg. It is hoped that there will be a centrally located section near the present Parliament Buildings, containing all civic offices. This would facilitate business transactions, especially for visiting business men.

It is planned to have each district a self-supporting community separated by main traffic arteries. This would make it unnecessary for children to cross streets carrying fast moving traffic to get to school.

Another plan to ensure the safety of the children is to have a small park accessible from every home without crossing a street. To do this the usual plan of cross streets would be altered so that only every second cross street would be continuous. With central heating, and modern homes containing a garage, the lanes to the rear of each house could be eliminated. The lots would be made smaller and this extra space used to make small parks or playgrounds.

The speaker stated that submerged cross-town highways are the most desirable but that they are not practical here because of the large initial and maintenance costs.

A large number of students attended, and all felt that here was an important post-war work and one of great interest to all citizens.

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. Standards, 1944; Part I—Metals:
Philadelphia, American Society for Testing Materials, c1945. 9½ x 6¼ in.

American Universities and Colleges; 4th ed.:
Clarence Stephen Marsh, ed. Wash., American Council on Education, 1940. 9 x 6¼ in.

Contributions to Soil Mechanics; 1925-1940:
Boston, Boston Society of Civil Engineers, c1940. 9¼ x 6¼ in.

Engineering for Dams:
William P. Creager, Joel D. Justin, and Julian Hinds. N.Y., John Wiley and Sons, Inc., c1945. 3 vols. 9½ x 6¼ in.

Mechanical and Electrical Equipment for Buildings; 2nd ed.:
Charles Merrick Gay and Charles De Van Fawcett. N.Y., John Wiley and Sons, Inc., c1945. 8¾ x 5¾ in.

National Fire Codes; Vol. I—Flammable Liquids, Gases, Chemicals and Explosives; 1945:
Robert S. Moulton, comp. Boston, National Fire Protection Association, c1945. 9¼ x 6¼ in.

Reinforced Concrete Design Handbook:
Detroit, American Concrete Institute, 1944. 9 x 6 in.

Steam Boiler Yearbook and Manual; 3rd ed.:
Sydney D. Scorer, ed. Lond., Paul Elek (Publishers) Ltd., c1945. 8¾ x 5¾ in.

PROCEEDINGS, TRANSACTIONS, ETC.

Canadian Electrical Association:
Proceeding of the Mid-Winter Conference, Montreal, January, 1945.

American Institute of Consulting Engineers:
Yearbook, 1945.

Engineering Foundation:
Annual Report, 1944.

Institution of Mining and Metallurgy:
Transactions, Volume 52, 1942-43.

Metropolitan Water District of Southern California:
Report of the Fiscal Year, Sixth, 1943-44.

REPORTS, TECHNICAL BULLETINS, ETC.

Canada—Department of Labour:
Annual Report, 1943.

Electrochemical Society:
Preprints: *87-4: Cataphoreses and Alundum Coatings.—87-5: Fused Salt Electrolysis for the Production of Metal Powers.—87-6: Melting and Evacuating Metals in a Vacuum.—87-7: Factors Affecting Phosphorescence Decay of the Zinc Sulfide Phosphors.—87-8: Some Broad Economic Implications of the Introduction of Hot-Cathode Fluorescent Lighting.—87-9: Color of Electrolytic Caustic Liquor.*

Ohio. State University. Engineering Experiment Station:
Bulletin No. 121: Stress Relief of Weldments for Machining Stability, by J. R. Stitt.

United States. Department of the Interior. Bureau of Mines:
Bulletin 459: *Potash Salts from Texas-New Mexico Polyhalite Deposits.*

Technical Paper:—*672: Carbonizing Properties and Petrographic Composition of Hazard No. 4 Coal from Columbus No. 4 Mine and High-Temperature Carbonizing Properties of Hazard No. 7 Coal from Hardburly Mine, Perry County, Ky.—673: Reserves, Bed Characteristics, and Coking Properties of the Willow Creek Coal Bed, Kemmerer District, Lincoln County, Wyo.—674: Semi-Pilot-Plant Investigations of Nitrogen Dioxide Process for Benefication of Manganses Ores.—675: Coke-Oven Accidents in the United States, 1943, by W. W. Adams and V. E. Wrenn.*

Miners' Circular:—*46: Explanation of Tentative Inspection Standards for Anthracite Mines.—51: Accident Statistics as an Aid to Prevention of Accidents in Metal Mines.*

PAMPHLETS

Application of Soil Mechanics in Designing Building Foundations:
A. Casagrande. American Society of Civil Engineers. Transactions, Vol. 109, p. 383, 1944. (Paper No. 2213.) Reprinted by Harvard University. Graduate School of Engineering. Soil Mechanics Series No. 23, 1944-45.

Cable Operation, 1942:
N.Y., Edison Electric Institute, Publication No. 51, 1944.

Canada's New Physical Metallurgy Research Laboratories:
Reprinted from Canadian Mining and Metallurgical Bulletin, July, 1944.

Cathode Ray Oscillograph and Its Application in Industry:
James L. Belyea. May, 1944 (Thesis awarded the Martin Murphy Prize, 1944).

Conservation Farming Practices and Flood Control:
Wash., U.S. Dept. of Agriculture. Miscellaneous Publication No. 253.

Drainage of Irrigated Farms:
Wash., U.S. Dept. of Agriculture. Farmers' Bulletin No. 805.

Electric Motors for the Farm:
Wash., U.S. Dept. of Agriculture. Farmers' Bulletin No. 1858.

Factory Planning Fundamentals:
Hal Gutteridge. Lond., Institution of Engineering Inspection, 1945.

Fair Day's Output from a Fair Day's Work:
A guide to Management of Essential Civilian Industries in Assessing, Diagnosing and Eliminating Manpower Loss. Wartime Prices and Trade Board, Ottawa, Industrial Division. Bulletin No. I.D. 100, January, 1945.

Industrial Service Bureau:
Brochure for presentation in the interests of Industrial Development. City of Chatham, Ont.

Post-war Development in Radio Engineering:
Part II—Education and Training. Lond., British Institution of Radio Engineers, 1944.

Practical Irrigation:
Wash., U.S. Dept. of Agriculture. Farmers' Bulletin No. 1922.

Publications and Visual Information on Soil Conservation; rev. January, 1944:
Wash., U.S. Dept. of Agriculture, Miscellaneous Publication No. 446.

Simplified Structural Steel Shapes; rev. January, 1944:
Approved by the U.S. Office of Production Management. N.Y., United States Steel Export Company, 1944.

Small Irrigation Pumping Plants:
Wash., U.S. Dept. of Agriculture, Farmers' Bulletin No. 1857.

Terrace Outlets and Farm Drainageways:
Wash., U.S. Dept. of Agriculture. Farmers' Bulletin No. 1814.

Training for To-day and for New Horizons:
General Motors Institute, 1944.

BOOK NOTES

Prepared by the Library of the Engineering Institute of Canada

ARCTIC MANUAL

By Vilhjalmur Stefansson, New York, Toronto, Macmillan, 1944, 556 pages, illustrated, cloth, price $3.50.

Prepared under the direction of the chief of the Air Corps, U.S. Army with a special introduction and index, This is an all-important picture of the arctic as it really is. There is realistic advice on how to survive when stranded in that generally misunderstood region. The text originated for practical use. It begins with a discussion of the changing attitudes since the days of the Greeks. The author goes into details of the physical geography, climate, weather, light, animal and insect life, vegetation, shelter (how to build as well as how not to build a snow house), food (and game laws) and drinking, clothing and personal equipment, health, diet, dangers of monoxide poisoning, travel on land, over water and over ice. The book presents a fascinatingly broad general view of the living and working conditions in the arctic which differ so greatly from those to which most of us have been accustomed.

ROCKETS, The Future of Travel Beyond the Stratosphere

By Willy Ley, New York, Viking Press, Toronto, Macmillan, 1944, 287 pages, illustrations, tables, diagrams, cloth, price $4.50.

This book is the scientific record of the efforts made thus far in history to escape from this planet and to walk upon the moon and a discussion of the likelihood that this supreme ambition will be achieved. The idea of interplanetary travel is old, dating back at least to the ancient Greeks, but it was not until science discovered that rockets could propel themselves in a vacuum that the subject was advanced from the realm of mere wishing to a subject of practical experiment. Serious investigation in the field of space travel with rockets began about twenty years ago, and the author has been identified with the research since its inception, having completed and launched rockets, and having written learned theses on the science of rocket propulsion. In the present book he translates into popular terms the history and the practice of man's journey of the future. Complete bibliography of books and pamphlets is included at the end of the book.

WORKSHOP TECHNOLOGY, PART I, AN ENGINEERING COURSE

By W. A. J. Chapman, London, Edward Arnold & Co., Toronto, Longmans, Green & Co. C/1943, 303 pages, illustrated, tables, diagrams, cloth.

Fifteen years ago artisan professions were neglected by educationalists, by writers and by public thought. A state of affairs which led to a dearth of suitably qualified prospective workers. That the artisan is worthy of a reasonable social position, that the work he does calls for high skill and training is indicated. Written for the men who do such work and for those who aspire to it, the fundamental principles underlying workshop processes are clearly explained. The work covered in this volume is approximately that of the first two years of a part-time course in technical colleges and includes most of the material necessary for the City and Guilds Inter-Examinations in Machine Shop Engineering.

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.

AIR COMPRESSORS, Their Installation, Operation and Maintenance

By E. W. F. Feller. McGraw-Hill Book Co., New York and London, 1944. 460 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $4.50.

This handbook is intended for operating engineers and manufacturers interested in the selection, operation and maintenance of air compressors. The various types and designs are described, their performance discussed, and much practical information is presented in convenient form.

ANNUAL REPORT ON THE PROGRESS OF RUBBER TECHNOLOGY, Vol. 7, 1943

Edited by T. J. Drakeley, published by W. Heffer & Sons, Ltd., Cambridge, England, for the Institution of the Rubber Industry, 12 Whitehall, London, S.W.1, 1944. 129 pp., 9½ x 7 in., paper, 12s. 6d. (4s. 6d. to members).

This annual contains excellent reviews of developments in various fields: production, chemistry and physics, synthetic rubber, compounding, fibers and textiles, vulcanized rubber, tires, belting, hose and tubing, cables and electrical insulation, footwear, mechanical goods, flooring, surgical goods, solvents, sponge rubber, hard rubber, works processes, and machinery. Each report includes a bibliography. Name and subject indexes are provided.

ASPHALTS AND ALLIED SUBSTANCES, 2 Vols.

By H. Abraham. 5th ed. D. Van Nostrand Co., New York, 1945. 2,142 pp., illus., diagrs., charts, tables, 9¼ x 6 in., fabrikoid, $20.00.

After seven years this comprehensive work on the asphalts has been thoroughly revised and brought up to date. The history of the asphalts, their chemistry and origin, the varieties and occurrences are described, as well as those of pitches, tars, etc. Manufactured products and their uses are treated at length. Methods of testing are given fully. There are a large bibliography and a list of patents.

CHAMBER'S TECHNICAL DICTIONARY

Edited by C. F. Tweney and L. E. C. Hughes, rev. ed., with supplements. The Macmillan Co., New York, 1944. 975 pp., diagrs., charts, 8¼ x 5¼ in., cloth, $6.00.

This dictionary defines terms used in pure and applied science, in engineering and construction, in manufacturing and the skilled trades. The new edition has been revised and a supplementary list of nearly a thousand definitions added. It is the best work of its kind now on the market.

COST ACCOUNTANTS' HANDBOOK

Ronald Press Co., New York, 1944. 1,482 pp., charts, tables, 7½ x 4¾ in., cloth, $7.50.

This excellent handbook covers thoroughly the methods of cost accounting in manufacturing industries. The fundamental principles and the methods that cost accountants have worked out are presented and fully illustrated. In addition to its usefulness to cost accountants, the volume will be very useful to the engineering and production staffs and to managers.

DEMOCRACY UNDER PRESSURE, Special Interests vs. the Public Welfare

By S. Chase. Twentieth Century Fund, New York, 1945. 142 pp., tables, 8 x 5¼ in., cloth, $1.00.

In this report to the Twentieth Century Fund Mr. Chase discusses the drift toward monopoly in business, agriculture and labour that is growing in America, and its effect upon post-war adjustment. He names the leading pressure groups, tells why they exist, how they operate and what they want, and discusses their significance in our future.

ENAMEL BIBLIOGRAPHY AND ABSTRACTS, 1928 to 1939, inclusive, with Subject and Co-author Indexes

Compiled by E. H. McClelland, edited and published by The American Ceramic Society, Columbus, Ohio, 1944. 352 pp., tables, 11 x 7¾ in., cloth, $5.00.

This compilation provides full references to the literature published during the period 1928-39, with excellent abstracts. The arrangement is by authors, with an extensive, detailed subject index. The bibliography is a model for such works.

ENGINEERING CONTRACTS AND SPECIFICATIONS

By R. W. Abbett. John Wiley & Sons, New York; Chapman & Hall, Limited, London, 1945. 188 pp., diagrs., tables, 8¾ x 5¾ in., cloth, $2.25.

Upon the basis of experience both as a teacher and a contractor, the author has attempted to present in compact form some of the legal and business aspects of the engineering profession. The legal considerations in construction work are summarized, the types of contracts are described and the essentials of each type discussed. Examples of each type are shown. Bidding procedure is described. A chapter is devoted to specification writing.

ENGINEERING MATHEMATICS

By H. Sohon. D. Van Nostrand Co., New York, 1944. 278 pp., diagrs., charts, tables, 9¼ x 6 in., cloth, $3.50.

This book is intended for engineering students who have completed the study of the elementary calculus and for graduate engineers seeking to bolster their present knowledge of mathematics. Determinants and matrix theory, Fourier series, differential equations, vector algebra, and vector calculus are important subjects dealt with in the text. The theory and solution of algebraic equations in general are effectively covered.

HISTORICAL GEOLOGY, the Geologic History of North America

By R. C. Hussey. McGraw-Hill Book Co., New York and London, 1944. 491 pp., illus., maps, 8½ x 5¼ in., cloth, $3.50.

The geologic history of North America and its inhabitants throughout some two billion years is presented with emphasis on broad panoramas of important events. The beginning chapters discuss fossils, the concept of evolution, the origin of the earth and the geologic time scale. Succeeding chapters carry the development of this continent from the archeozoic era through the geologic history of man. The book is profusely illustrated.

INTERMEDIATE AERODYNAMICS

By R. W. Truitt. Pitman Publishing Corp., New York and Chicago. 1944. 227 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $3.75.

The important elements necessary for the accurate application of aerodynamics are presented with sufficient descriptive material to emphasize their practical use. Thorough mathematical explanations are given for problems relating to the airfoil, drag, stability, load factors, propellors, slots and flaps. A glossary of aeronautical terms is appended.

MacRAE'S BLUE BOOK AND HENDRICK'S COMMERCIAL REGISTER, 52nd Annual Ed. 1944-45

MacRae's Blue Book Co., Chicago and New York, 1945. 3,736 pp., illus., 11 x 8 in., cloth, $15.00.

The major part of this standard annual buyers' guide is a comprehensive alphabetical list of products, with the manufacturers arranged alphabetically under each product. In some of the larger classifications there is a geographical arrangement first, then alphabetical. Preceding this section is a complete alphabetical file of manufacturers giving full addresses, capital ratings and local distributors. A three hundred page list of trade names is included at the back of the volume.

METALLOGRAPHY OF MAGNESIUM AND ITS ALLOYS, a translation from the German by the technical staffs of F. A. Hughes & Co. Limited and Magnesium Elektron Limited of "Metallographic des Magnesiums und seiner technischen Legierungen"

By W. Bulien and E. Fahrenhorst. F. A. Hughes & Co., Limited, Abbey House, London, N.W.1, England, 1944. 117 pp., illus., tables, 9½ x 6 in., cloth, 15s.

This, the first book devoted solely to the metallography of magnesium and its alloys, appeared in Germany in 1942. The translation is by the staffs of British producers of the metal. The book opens with a short description of polishing and etching technique, which is followed by a description of the alloy constituents and impurities that are discernible in micrographs. The remainder of the book discusses 225 micrographs that are presented and the information that they reveal as to the nature of the alloy, its pretreatment and its faults. To the references in the original edition, the translators have added a list of non-German references.

MILLING MACHINE OPERATIONS

By L. E. King. The Macmillan Co., New York, 1944. 123 pp., illus., diagrs., tables, 8½ x 5½ in., paper, $1.75.

A guide for apprentices and students in shop courses, intended to teach the performance of various milling machine operations.

MODERN GAS TURBINE

By R. T. Sawyer. Prentice-Hall, New York, 1945. 216 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.00.

This work presents a good picture of the gas turbine as it exists today. The history of its development is given briefly, its fundamental theory explained and its applications discussed. Uses as a supercharger on diesel and air caft engines, in industry and in marine service are treated at some length. A chapter is devoted to gas-turbine locomotives and one to jet propulsion.

THEORY AND APPLICATIONS OF ELECTRON TUBES

By H. J. Reich. 2 ed. McGraw-Hill Book Co., New York and London, 1944. 716 pp., illus., diagrs., charts, tables, 9 x 5¾ in., cloth, $5.00.

This book is intended to give, in one volume, a sufficiently thorough grounding in the fundamentals of electron tubes and associated currents to enable the student to apply these tubes to the solution of new problems. The basic principles are presented, with special attention to their application to industrial electronics, power control, electrical measurements and other fields of use. The new edition has been brought up to date.

THEORY OF X-RAY DIFFRACTION IN CRYSTALS

By W. H. Zachariasen. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 255 pp., diagrs., charts, tables, 8½ x 5½ in., cloth, $4.00.

This book aims to give a logical presentation of both the theory of crystal symmetry and the theory of x-ray diffraction in crystals.

VIBRATION ANALYSIS

By N. O. Myklestad. McGraw-Hill Book Co., New York and London, 1944. 303 pp., diagrs., charts, tables, 8½ x 5¼ in., cloth, $3.50.

The first five chapters are written from the textbook point of view to provide an understanding of the various phases of the phenomenon of vibration. Important topics covered are undamped and damped vibrations of systems of one degree of freedom and vibrations of systems with more than one degree of freedom. The last chapter deals with applications to important practical problems, chiefly in the aeronautical field.

NOTICE TO STUDENTS

Student members of the Institute who are about to leave the university, whether definitely or only for the summer season, are requested to inform Headquarters of their new address, so that the *Journal* may be forwarded to them.

This is particularly important in the case of those who live in fraternities or boarding houses during the scholastic year. With present restrictions on the use of paper, it is imperative that no copies of the *Journal* go to waste.

Don't forget to inform us of your new address when returning to college in the Fall. Headquarters will change your mailing address as often as necessary provided you supply the information.

All changes should be recorded with the General Secretary, 2050 Mansfield St., Montreal 2.

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

March 31st, 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 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 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 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

ANDREWS—GEORGE THOMAS LESLIE, of Blackdale, Man. Born at Winnipeg, Man. Educ.: B.Sc. (Elec.), Univ. of Man., 1932; 1934-36, surveying and mapping, levels and earthwork quantities, pipeline laying and pumping operations, plant constrn. details and design for sodium sulphate development work, and 1936-37, dftsman. and supervisor on sodium sulphate crystallization plant involving plant bldg. constrn., plant equipment and lighting, plant operation and mtce., Oban Salt Co. Ltd., Oban, Sask.; 1937-39, engr. engaged in study of sodium sulphate plant operation, reports and proposals for extended plant operation and constrn., East Crest Oil Co. Ltd., Calgary, Alta.; 1940-41, dftsman., D.I.L. powder plant, Montreal, and 1941-44, mtce. engr. for acid and nitrocellulose depts. of D.I.L. smokeless powder plant, Valleyfield, Que. At present engaged in agriculture with a view to keeping home farm and continuing engrg. practice.

References: D. A. Killam, D. S. Laidlaw, E. P. Fetherstonhaugh, N. M. Hall, F. V. Seibert.

ARMSTRONG—GEORGE EARNEST, of Ottawa, Ont. Born at Millbridge, Ont., Oct. 22nd, 1909. Educ.: 1944, grad. of special electrical course at N.S. Tech. Coll., given to selected personnel in the Navy qualifying them for commissioned office. (Course approved by Council as meeting requirements for Junior); 1927-41, with the H.E.P.C. of Ontario as follows: 1927-29, lineman, constrn. dept., 1929-34, electrician, constrn. dept., 1934-39, electrician, operating dept., 1939-41, electrician foreman, operating dept.; 1941 to date, with the R.C.N.R., at present, Elect. Sub.-Lieut., Directorate of Elec. Engrg., Naval Service Hdqrs., Ottawa.

References: F. H. Sexton, G. H. Burchill, W. H. G. Roger, J. J. Smith, . Deane, H. E. Brandon.

ARSENAULT—JOSEPH CYRIL, of 136 Pleasant St., Dartmouth, N.S. Born at Summerside, P.E.I., Jan. 31st, 1910. Educ.: 1928-31, St. Francis Xavier Univ., 1931-37, apprentice study with J. E. Harris, architect, and E. S. Blanchard, Charlottetown, P.E.I., on arch'tl. engrg. design; 1939-45, Works Officer, R.C.E., Lieut. and Capt. on design and supervision of engr. works incl. fortifications, accommodation and outside services as elec. power, installn. and transmission, sewer and water supply; 1937-39, design and supvervn. of refinery bldgs. and equipment, July and August, 1939, and April, 1945, to date, mtce. engr., maritime marketing divn., Imperial Oil Limited, Halifax, N.S.

References: J. A. Aitken, E. L. Baillie, C. Scrymgeour, J. F. C. Wightman, J. F. MacKenzie, W. S. Lawrence.

BASTIN—DOUGLAS HALFORD, of Vancouver, B.C. Born at Vancouver, March 10th, 1919. Educ.: B.A.Sc. (Elec.), Univ. of B.C., 1942; 1942-43, senior research asst. divn. of physics and elec. engrg., National Research Council; March, 1943, to date, Elect. Lieut., R.C.N.V.R., Naval Research Establishment, H.M.C.S. Stadacona, Halifax, N.S.

References: H. J. MacLeod, A. F. Peers.

BATZOLD—JACK CARTER, of Montreal, Que. Born at St. Thomas, Ont., Sept. 4th, 1909. Educ.: B.Sc., Queen's Univ., 1933; 1931-35, ap'tice, Aluminum Co. of Canada, Toronto; 1935-36, asst. plant supt., 1936-40, mines mech. engr., and 1940-43, chief engr., Demerara Bauxite Company, British Guiana; 1943-45, deputy manager, mining dept., Aluminum Co. of Canada, Montreal, Que.

References: A. W. Whitaker, Jr., M. P. Weigel, F. L. Lawton, D. W. Miller, M. E. Hornback.

BLANCHART—PAUL, of 4602 Decarie Blvd., Montreal, Que. Born at Turin, Italy (Belgian Nationality), Feb. 8th, 1906. Educ.: Candidat Ingenieur, Univ. of Liege, Belgium, 1927; 1931-40, chief of a dept. of mfg. and installns., Pittevil & Co., Brussels, gen. representatives of Armstrong-Vickers in Belgium; 1942 to date, with the Canadian Car & Foundry Co. Ltd., first as supervisor of hydraulic dept. (now engrg. dept.), and at present, dftsman. and engr., aircraft design and layout.

References: R. N. Dobson.

DEVLIN—JOHN, of Calgary, Alta. Born at Largs, Scotland, Dec. 20th, 1897. Educ.: James Watt School of Marine Engrg., Greenock. Chief Engr's. Cert., Board of Trade, 1926; 1914-20, engrg. ap'ticeship. and journeyman engr. with Scotts Shipbldg. & Engrg. Co., Greenock; 1920-26, junior engineer-officer, Cunard Line and P. & O. S. N. Company, Liverpool and London; 1926-29, senior engineer-officer, i/c of watch, various vessels, P. & O. S. N. Company, London; 1934-42, lubrication engr., i/c of technical phase of industrial and railroad business, Winnipeg, and 1942 to date, manager, industrial and automotive lubrication, McColl-Frontenac Oil Co. Ltd., i/c of technical phase of western divn., industrial and automotive business, Calgary, Alta.

References: J. S. Neil, J. G. McGregor, T. D. Stanley, N. M. Hall, R. W. Jickling.

EDGETT—CONRAD SEATON, of 71 Broadview Ave., Moncton, N.B. Born at Hillsboro, N.B., Feb. 22nd, 1905. Educ.: Acadia Academy. I.C.S.; 1926-33, rly. constrn., C.N.R.; 1933, hydro constrn., N.B. Electric Power Commn.; 1934-38, rly. constrn., C.N.R.; 1938-44, with Dept. of National Defence and Dept. of Transport, Civil Aviation, on various airports, and radio stations—1938-39, foreman i/c of constrn., doing own instrument work, 1940-42, surveys, etc., 1938-42 (part time), district engr's. office, 1942-43 (2 years), res. engr., 1944, lab., final record plans. At present, instrumentman, C.N.R., Moncton, N.B.

References: E. C. Percy, A. Gordon, A. S. Donald, J. F. MacKenzie, J. E. J. Patterson, G. C. Torrens.

GARVIN—ALBERT LORNE, of 2156 Daniel St., Trail, B.C. Born at Montreal, Oct. 29th, 1890. Educ.: Structural steel designing, Soldiers Civil Re-establishment School, Montreal, 1919; I.C.S.; 1913-14, detailer, Dominion Bridge Co., Lachine; 1914-19, overseas; 1919-22, detailer, Dominion Bridge Co., Toronto and Winnipeg; 1922-23, detailer and checker, Manitoba Bridge & Iron Works, Winnipeg; 1923-32, detailer and checker with the following firms—Almira Iron Works, Chicago; Hamilton Bridge Co., McGregor-McIntyre Co. Ltd., later, Dominion Bridge Co., Canadian Bridge Co., and John T. Hepburn Co.; 1934-35, rodman, B.C. Govt. Works Dept., Nelson, B.C.; 1935 to date, with the Consolidated Mining & Smelting Co. Ltd., at Tadanac, B.C., as detailer and checker, and from 1938 to date, designing dftsman.

References: A. C. Ridgers, S. C. Montgomery, J. V. Rogers, T. W. Lazenby, C. E. Marlatt, A. Dickson, E. T. Bridges.

GNAEDINGER—JOHN BURGESS, of Westmount, Que. Born at Westmount, Aug. 8th, 1914. Educ.: B.Eng., McGill Univ., 1939; 1939, chief chemist, 1940-41, mine foreman, and 1941-43, railroad supt., Demerara Bauxite Company, British Guiana; 1944 to date, asst. mining engr., Aluminum Company of Canada Ltd., Montreal, Que.

References: A. W. Whitaker, Jr., M. P. Weigel, F. L. Lawton, D. W. Miller, H. Jomini, F. T. Gnaedinger.

GRAVEFELL—ALFRED, of Hamilton, Ont. Born at Workington, Cumberland, England, March 15th, 1897. Educ.: 1918-20, Armstrong College-Durham Univ.; 1914-18, Imperial Army; 1919-22, practical mining-survey and mech'l.; 1922-23, trans. line, survey and inspr., N.S. Power Commn.; 1923-24, mech'l. transmissions, Jones Glasgow, Montreal; 1924-27, i/c Chrysler Corpn. bldg. extension, for Borden Constrn. Co.; 1927-32, field engr., and 1932-42, asst. and supt. mtce., Ford Motor Company; 1942 to date, mtce. engr., Hamilton Bridge Co. Ltd., Hamilton, Ont.

References: H. J. A. Chambers, W. B. Nicol, W. S. MacNamara, N. L. Crosby, C. C. Parker.

GREEN—JOHN JOSEPH, M.B.E., of Ottawa, Ont. Born at Portsmouth, England, Nov. 9th, 1905. Educ.: 1926-30, Royal College of Science, London University, B.Sc., A.R.C.S., D.I.C., Ph.D.; A.F.R.Ae.Soc., A.F.I.Ae.Sciences; 1930-34, junior research physicist, 1934-43, asst. research engr., head of aerodynamic lab., National Research Council; 1943-45, chief research engr. (Squadron Leader), Test and Development Establishment, R.C.A.F., respons. for all engrg. connected with flight testing. At present, chief research aeronautical engr., Air Transport Board, Ottawa, Ont.

References: A. Ferrier, J. H. Parkin, C. J. Mackenzie, R. W. Boyle, T. R. Loudon, J. A. Wilson, E. W. Stedman, J. T. Dyment, B. G. Ballard, R. J. Moffett.

HUNT—WILLIAM HAROLD, of 336 Maplewood Ave., Winnipeg, Man. Born at Lennoxville, Que., Nov. 24th, 1884. Educ.: B.Sc. (Civil), Univ. of Man., 1913; R.P.E. of Man.; 1917-40, district engr., Manitoba Good Roads Board; 1940-45, on active service, Canadian Army, Major, R.C.E.; Jan., 1945, to date, district engr., highway dept., Dept. of Public Works of Man., Winnipeg, Man.

References: E. P. Fetherstonhaugh, G. E. Cole, F. S. Adamson, D. M. Stephens, A. J. Taunton.

HUYCK—CHARLES BERTRAM, Major, R.C.E.M.E., of Ottawa, Ont. Born at Tweed, Ont., Oct. 18th, 1889. Educ.: 1908-10, Queen's Univ.; 1910-14, with Mussen's Ltd., Cobalt and Montreal; 1914-18, served with Royal Canadian Engrs.; 1918-28, branch mgr., Mussens Ltd., Vancouver, B.C.; 1928-32, sales mgr., Brown Fraser & Co., Vancouver; 1935-39, sales engr., Dominion Engrg. Co., and Dominion Bridge Co., Vancouver and Nelson, B.C.; 1941-44, with Directorate of Mechanical Maintenance, R.C.O.C., N.D.H.Q., Ottawa; 1944 to date, general engineering section, R.C.E.M.E., N.D.H.Q., Ottawa, Ont.

References: D. S. Ellis, J. M. Wardle, H. G. Thompson, N. B. MacRostie, A. S. Gentles, J. Robertson, H. S. Van Patter.

HOWIE—ROSS ELLISON, of Pike River, Que. Born at Pike River, April 1st, 1921. Educ.: B.Eng. (Mech.), McGill Univ., 1944; Summer, 1942, machine shop work, Northern Electric Co. Ltd., Montreal; not engaged in engrg. work at present, but will do so as soon as efficient farm labour becomes available.

References: A. R. Roberts, C. M. McKergow, R. DeL. French, F. M. Wood, E. Brown.

JOPP—JAMES MELVILLE, of 148 Simpson St., Sault Ste. Marie, Ont. Born at Kaleida, Man., Sept. 22nd, 1902. Educ.: B.Sc. (Elec.), Univ. of Wisconsin, 1925 (Accredited E.C.P.D.); 1926 to date, engr. with the Abitibi Power and Paper Company, Sault Ste. Marie, Ont.

References: G. W. Holder, N. C. Cowie, M. W. Turner, C. Stenbol, W. D. Adams.

KENNEDY—THOMAS FOWLER, Sqdn.-Ldr., R.C.A.F., of St. Andrew's, N.B. Born at Woodstock, N.B., Jan. 27th, 1914. Educ.: B.Sc. (Civil), Univ. of N.B., 1941; 1941 to date, Air Navigator, R.C.A.F., instructional and operational duties. At present, chief ground instructor, Transport Conversion Squadron, R.C.A.F., Pennfield Ridge, N.B.

References: E. O. Turner, J. H. Moore, F. H. C. Sefton, J. Stephens, L. O. Cass.

LINDSAY—DONALD ALEXANDER, Capt., R.C.E., of 24 Elliott Row, Saint John, N.B. Born at Woodstock, N.B., June 28th 1898. Educ.: B.Sc. (Elec.), Univ. of N.B., 1922; R.P.E. of N.B., 1944; 1922-24, on test floor, 1924-27, service engr., Westinghouse Electric Mfg. Co.; 1927-40, mgr., Woodstock Electric Light & Power Co., Woodstock, N.B.; 1940-41, Civil Service of Canada; 1941 to date, Works Officer, R.C.E., at present stationed at Saint John, N.B.

References: H. A. Stephenson, E. O. Turner, J. Stephens, B. H. Hagerman, C. D. McAllister.

MACKAY—SAMUEL LECKIE, of 8496 Montcalm St., Vancouver, B.C. Born at Glasgow, Scotland, April 24th, 1902. Educ.: 1918-24, five years' ap'ticeship as fitter and turner, Singer Sewing Machine Co. Ltd., Clydebank, Scotland, also one year in drawing office; Continuation classes in engrg. during this period at Clydebank High School; 1924-30, mech. dftsman., with various firms in Montreal; 1931-36, sales engr., Climax Co. Ltd. and Sound Engrg. Co. Regd., Montreal; 1936-41, mech. engr., later beater room supt., Pacific Mills Ltd., Ocean Falls, B.C.; 1941-42, production engr. i/c design and operation of production control system, Wartime Shipbldg. Ltd., Vancouver; 1942-44, plant engr., Vivian Diesels & Munitions Ltd., Vancouver, B.C.; 1944 to date, mgr., mech. design and sales, Engineering & Machinery Ltd., Vancouver, B.C.

References: C. W. E. Locke, A. C. R. Yuill, W. R. Bonnycastle, H. M. Lewis, G. H. Bancroft, A. S. Mansbridge.

MANSON—CHARLES ALEXANDER, Lieut.-Colonel, of 236a Rideau St., Ottawa, Ont. Born at Lachine, Que., Nov. 4th, 1907. Educ.: B.Sc. (Elec.), McGill Univ., 1929; Special Army Radar Course, Army School, Mil. College of Science, England; 1929-39, sales engr., Northern Electric Co. Ltd., Montreal and Ottawa; 1940-42, chief instructor, Radio Waig, A23TC (Radar Instr.); 1942-43, asst. director radar design sect., Army Engrg. Design Branch, Dept. of Munitions & Supply; April, 1943, to date, asst. director i/c Radar design sect., Directorate of Artillery, M.G.O. Branch, N.D.H.Q., Ottawa, Ont.

References: R. E. Jamieson, LeS. Brodie, J. E. Breeze, H. G. Thompson, E. C. Mayhew, H. P. Cadario.

McDIARMAID—LORNE GRANT, of 8620 Hudson St., Vancouver, B.C. Born at Edmonton, Alta., Feb. 28th, 1921. Educ.: B.Sc., 1943, M.Sc., 1944, Univ. of Alta.; Summers—1941-42, seismograph surveys, 1943, chemist, Imperial Oil Ltd., Calgary. At present, general manager and chief engr., Insulation Industries Ltd., Vancouver, B.C.

References: J. G. Dale, J. W. Porteous.

MOORE—DAVID IAN, Constructor Lieut., R.C.N.V.R., of 320 Cooper St., Ottawa, Ont. Born at Port Alberni, B.C., Nov. 3rd, 1919. Educ.: 1936-39, indentured ap'ticeship, gen. shipbldg., Messrs. J. I. Thornycroft, Southampton, England; 1939, recd. National Cert. in Naval Architecture, awarded by Inst. of Naval Architects, after part-time course at University College, Southampton; 1939-40, attended a full-time course for a year at same college, which would normally have led to the Intermediate Exam. B.Sc. (Engrg.), London Univ.; 1940-42, ship dftsman., Canadian Vickers Ltd., Montreal; 1942-44, asst. section head, new constrn. naval vessels i/c drawings and specifications, 1944-45, senior officer, calculations and design section, Directorate of Naval Construction, Ottawa, Ont.

References: G. L. Stephens, A. C. M. Davy, A. L. C. Atkinson, J. Middleton.

MORRIS—HARRY ALFRED, of Red Rock, Ont. Born at Winnipeg, Man., Dec. 23rd, 1886. Educ.: Mech. Engrg., I.C.S., Mining Engrg., Can. Inst. of Sc. & Technology; 1925 to date, master mechanic with various firms, including Fraser Brace Engrg. Company, Montreal Light Heat and Power Cons., and at present, master mechanic with Brompton Pulp & Paper Company, Red Rock, Ont. (Asks for admission as Affiliate.)

References: B. K. Boulton, C. G. Kingsmill, H. F. Abbott, G. R. Stephen.

NEWLAND—ALFRED, Lieut. Commdr. (E), R.C.N.R., of Halifax, N.S. Born at Portsmouth, England, Feb. 3rd, 1907. Educ.: 1924-29, gen. engrg. ap'ticeship, incl. experimental lab. work, Ruston & Hornby, Ltd., Lincoln, England. Organized evening classes in conjunction with ap'ticeship at Lincoln College of Engrg.; First Class Board of Trade Cert., London, England, 1933. Member, Inst. of Marine Engrs., London, 1934; 1929-34, engr. with Jas. Chambers & Co. Ltd., Lancashire Shipping Co., Liverpool, England; 1934-35, design and supervn., marine technical dept., Ruston & Hornby Ltd., of Lincoln, England; and 1935-36, travelling in Canada for this firm as marine technical adviser; 1936-41, with A. R. Williams Machinery Co., Vancouver, agents for Ruston & Hornby Ltd., i/c gen. tech. work in connection with Ruston diesel installns. in western Canada, marine and stationary; 1941 to date, with R.C.N.R., at present, officer in charge, M.L. Repair Depot, H.M.C. Dockyard, Halifax, N.S.

References: J. R. Grant, T. W. Fairhurst, F. L. Thompson, H. F. Kent, W. H. G. Roger.

PARLEE—NORMAN ALLEN DEVINE, of 109 Bentinck St., Sydney, N.S. Born at South Farmington, N.S., March 23rd, 1915. Educ.: B.Sc., 1935, M.Sc., 1937, Dalhousie; Ph.D., (Chem.), McGill Univ., 1939; Summers, 1937-38, and 1939-41, with Dom. Steel & Coal Corpn.; 1941-42, acting chief inspr. and metallurgist, Trenton steel works, N.S. Steel & Coal Company; 1942-44, research chemist and metallurgist, and 1944 to date, asst. chief metallurgist i/c of development and research, Dominion Steel & Coal Corporation, Sydney, N.S.

References: C. M. Anson, W. S. Wilson, J. H. Fraser, J. A. Macleod, M. W. Booth, J. A. Russell, S. G. Naish, C. M. Smyth.

SCHROTER—BERNARD H., Sqdn.-Ldr., R.C.A.F., of Vernon, B.C. Born at Hongkong, Sept. 10th, 1906. Educ.: B.A.Sc., Univ. of Hongkong, 1930; 1931-32, managing director, South China Pencil Co., Canton, China; 1933-34, partner, Schroter Bros., holding controlling interests in South China Pencil Co., Mophone Gramophone Co., and Radio Divn., Canton Trading Assn. Ltd.; 1940 to date, with the aeronautical engineering section, R.C.A.F., at present, chief engr. officer, No. 1 G. & N. S., Summerside, P.E.I.

References: J. W. Lucas, J. M. Pope, D. D. Cunningham.

WARRINGTON—GEORGE ALBERT, of 150 Elm St., Winnipeg, Man. Born at Cornwall, Ont., Sept. 5th, 1887. Educ.: B.A.Sc., Univ. of Toronto, 1910; R.P.E. of Man.; 1912-13, Manitoba Good Roads Board; 1913-45, locating and surveying roads in Manitoba as a Dominion and Manitoba Land Surveyor. At present, chief surveyor, Dept. of Public Works, Manitoba, Winnipeg, Man.

References: V. H. Campbell, G. Affleck, G. W. Campbell, D. N. Sharpe.

WILLIAMS—GERALD B., of Winnipeg, Man. Born at Winnipeg, June 21st, 1913. Educ.: B.Sc. (Civil), Univ. of Man., 1935; R.P.E. of Man.; 1935-37, gravel inspr., instr'man., bituminous paving inspr.; 1937-40, lab. engr. and engr. i/c bituminous surfacing; 1940 to date, materials engr., highways branch, Dept. of Public Works, Prov. of Manitoba, Winnipeg, Man.

References: C. V. Antenbring, F. S. Adamson, G. H. Herriott, D. M. Stephens, L. A. Wright.

WOOD—JOHN RICHARD, of 353 Downie Street, Peterborough, Ont. Born at Edmonton, Alta., Oct. 1st, 1920; Educ.: B.Sc. (Elec.), Univ. of Alta., 1944; 1943 to date, student engr., test dept., Can. Gen. Elec. Co. Ltd., Peterborough, Ont.

References: A. L. Malby, B. Ottewell, W. T. Fanjoy, D. V. Canning, J. A. Allan.

FOR TRANSFER FROM JUNIOR

CARRICK—STANLEY MIRUS, of 365 Selkirk Ave., Winnipeg, Man, Born at Winnipeg, Man., Dec. 5th, 1911. Educ.: B.Sc. (Civil), Univ. of Man.. 1944 (1928-33 and 1943-44); 1936, asst. highway engr. and 1937, resident engr., Good Roads Dept., Manitoba Govt.; 1938, engr. for Dufferin Paving Co. at Kenora, Ont.; 1939, sales engr. for Vulcan Iron Works; 1940, asst. engr. on constrn. of airfields at Dauphin, Man.; 1941, group engr. on constrn. of plant at Pickering, Ont.; 1941 to 1943, engr. of constrn. at No. 8 Repair Depot, R.C.A.F., Winnipeg; 1944 (6 mo.), reinforced concrete engr. with Cowin & Co., Winnipeg; at present designg. engr., C.P.R., Winnipeg, on post-war projects. (Jr. 1944.)

References: A. E. MacDonald, E. P. Fetherstonhaugh, W. F. Riddell, G. H. Herriot, N. M. Hall, C. V. Antenbring, A. J. Taunton, C. H. Fox.

COWAN—GEORGE ARCHIBALD, of 549 Campbell St., Winnipeg, Man. Born at Kennedy, Sask., Dec. 8th, 1916. Educ.: B.Sc. (Mech.), Univ. of Sask., 1938; 1938-40, sales and service, Intnl. Harvester Co. of Can.; 1941 to date, sales and service engr., Railway & Power Engrg. Corpn. Ltd., Winnipeg branch. (Jr. 1944.)

References: C. P. Haltalin, D. Hunter, G. R. Pritchard, T. E. Storey, H. L. Briggs, I. M. Fraser.

GIRDWOOD—ARTHUR JAMES, of 493 Thompson Ave., Peterborough, Ont. Born at North Bay, Ont., June 22nd, 1911. Educ.: B.A.Sc., Univ. of Toronto, 1934; R.P.E. of Ont.; with Can. Gen. Electric as follows: 1934-35 on tests; 1935-36, student course; 1937-45, designing engr.; at present senior engr. (Jr. 1936.)

References: H. R. Sills, B. Ottewell, G. R. Langley, R. L. Dobbin, B. I. Burgess.

GOODMAN—HYMAN BERNARD, of 5653 Hutchison St., Montreal, Que. Born at Montreal, July 7th, 1909. Educ.: 1926-31, mech. engrg., McGill Univ. (two subjects to complete in final year); 1937-38, instr'man. and inspn. of constrn., Donald-Hunt Ltd., Montreal; 1938-39, senior research lab. asst., 1939-40, engr. i/c D.O. records, 1940-43, tool designer, etc., Canadian Car & Foundry Co. Ltd., Montreal; April, 1943, to date, tool and production methods engr., Electric Tamper & Equipment Co. of Canada Ltd. and H. E. McKeen & Co. Ltd., Montreal. (St. 1928, Jr. 1937.)

References: E. H. Moffatt, D. J. Lafontaine, O. J. McCulloch, L. S. Berenstein, I. S. Backler, B. A. Berger.

HAMILTON—HAROLD PERCY, of Flin Flon, Man. Born at Regina, Sask., June 6th, 1912. Educ.: B.A.Sc. (Elec.), Univ. of Toronto, 1934; 1939 to date, designer and dftsman., Hudson Bay Mining & SmeltingCompany, Flin Flon, Man. (Jr. 1938.)

References: M. K. T. Reikie, W. S. Black, S. H. Hawkins, J. V. Rogers, F. S. Small, P. C. Perry, J. T. Nichols.

HARVEY—ERNEST ALLAN, F/L, R.C.A.F., of Patricia Bay, B.C. Born at Durban, Man., Feb. 27th, 1910. Educ.: B.Sc. Univ. of Sask., 1945, and B.Sc.

(Elec.), Univ. of Man., 1938; R.P.E. Ont.; with the Maytag Co. Ltd., Toronto, as follows: 1938-39, plant engineer and 1939-41, factory manager; with R.C.A.F. as follows: 1941, School of Aeron. Engrg., Montreal; 1941-42, with Directorate of Aeron. Engrg. at Air Force HQ, Ottawa, and 1942-44, as development engrg. officer at A.F.H.Q., Ottawa; at present, aeron. engrg. officer i/c maintnce. elect. and instr. equipment in aircraft at No. 3 O.T.U. (Jr. 1940)

References: Alan Ferrier, E. P. Fetherstonhaugh, K. Y. Lochhead, A. H. Douglas, C. W. Crossland, J. I. Gould.

THOMAS—JAMES MACLEOD, of Pictou, N.S. Born at Fredericton, N.B., Jan. 8th, 1910. Educ.: B.Sc. (Elec.), 1932, B.Sc. (Civil), 1933, Univ. of N.B.; R.P.E. of N.B.; 1937-40, res. engr., Dept. of Highways of N.B.; 1940-42, dftsman. and designer, Foundation Company of Canada, 1942-44, planning engr., 1944-45, planning and production engr., Foundation Maritime Ltd., and at present, designing engr., Foundation Company of Canada Ltd., Montreal, Que. (St. 1935, Jr. 1938.)

References: H. V. Serson, W. Griesbach, R. E. Chadwick, C. B. Croasdale, W. J. Lawson, R. F. Shaw.

TWEEDDALE—REGINALD ESTEY, F/L, R.C.A.F., of Perth, N.B. Born at Arthurette, N.B., Dec. 24th, 1914. Educ.: B.Sc. (Elec.), Univ. of N.B., 1935; 1935-37, instr'man. on constrn. of new highway; 1937-38, asst. dist. highway engr.; 1938-40, dist. highway engr.; since 1940, in Technical Signals (Radar), R.C.A.F. (Jr. 1937.)

References: C. B. Croasdale, A. F. Baird, W. J. Lawson, E. O. Turner, W. C. MacDonald, John Stephens.

WHITELEY—ERIC, of 611 Weller St., Peterborough, Ont. Born at Sheffield, Eng., July 23rd, 1911. Educ.: B.A.Sc., Univ. of Toronto, 1937; with Can. Gen. Electric as follows: 1937-38, student engrg. course; 1938 to date, asst. D.C. engr. (Jr. 1939.)

References: G. R. Langley, H. R. Sills, I. F. McCrae, B. Ottewell, A. R. Jones, E. R. Shirley.

FOR TRANSFER FROM STUDENT

BENNETT—JOHN ROBERT GORDON, Capt., R.C.C.S., of 288 Nelson St., Ottawa, Ont. Born at Fort William, Ont., Dec. 18th, 1920. Educ.: B.Eng., McGill Univ., 1942; 1942 to date, officer in the Royal Canadian Corps of Signals, N.D.H.Q., Ottawa, Ont. (St. 1942.)

References: C. V. Christie, R. E. Jamieson, G. A. Wallace.

BIRT—THOMAS WILLIAM, W/C, R.C.A.F., of Bryce Apts., Winnipeg, Man. Born at Winnipeg, Man., Sept. 5th, 1913. Educ.: B.Sc. (Elec.), Univ. of Man., 1938; 1939 to 1940, Northern Electric Co., Montreal; 1941 to 1945, with R.C.A.F. in aircraft engrg. branch, at present Chief Engrg. Officer, No. 9 B. & G. School, Paulson, Man. (St. 1939.)

References: E. P. Fetherstonhaugh, G. M. Minard, J. T. Rose.

BOURGEOIS—PATRICK O., of London, Ont. Born at Kenogami, Que., Jan. 28th, 1919. Educ.: B.Sc. (Civil), Queen's Univ., 1944; 1944 to date, field engr. with Intrnl. Water Supply Ltd., London, Ont. (St. 1943.)

References: C. Miller, P. C. Kirkpatrick, D. S. Ellis, T. L. McManamna, R. A. Low, R. S. Charles.

GARTON—JOHN McCONNELL, of Sarnia, Ont. Born at London, Eng., Jan. 26th, 1919. Educ.: B.Eng., McGill Univ., 1942; R.P.E. of Que.; 1942-45, Research work of an engrg. nature with Imperial Oil Ltd., Sarnia, Ont. (St. 1942.)

References: A. P. Shearwood, G. L. Macpherson, J. B. Phillips, C. P. Warkentin, F. P. Shearwood.

GRIFFITHS—GEORGE HENRY RICKARD, of Montreal. Born at Winnipeg, Man., Aug. 30th, 1913. Educ.: B.Sc. (Civil), Univ. of Man., 1935, and M.Eng. (Civil), McGill Univ., 1938; 1935-36, demonstr., Univ. of Man.; 1936-37, Sol d'Or and Kirkroyale Gold Mines as asst. engr.; with L'Air Liquide Society as follows: 1938-39, sales dept.; 1940-41, research dept.; 1942-43, dist. engr.; 1943 to date, head constrn. divsn. (St. 1935.)

References: R. E. Jamieson, A. E. Macdonald, J. R. Stewart, F. G. Kerry, D. W. Miller.

HAMILTON—HARRY IRWIN, of Mackenzie, British Guiana. Born at Toronto, Ont., May 1st, 1918. Educ.: B.Sc. Queen's Univ., 1941; 1941, R.C.A Victor, Montreal, expeditor; 1941-42, instructor in elect. engrg., Queen's Univ.; 1942 to date, with Demerara Bauxite Co., British Guiana as follows: one year supvisg. field maintnce. and repairs, and at present mechan. engr. at Ituni Mines. (St. 1941.)

References: J. L. Lang, LeR. Brown, A. Jackson, L. T. Rutledge, R. E. Williams.

HEATH—FREDERICK JOHNSTON, of Toronto, Ont. Born at Edmonton, Alta., March 20th, 1916. Educ.: B.Sc. (Elec.), Univ. of Alta., 1938, and post-grad. M.I.T., 1938-40; 1940-42, jr. research engr. on development of Radar equipmt., National Research Council; 1942 to date, senior radio equipmt. engr. for R.C.A.F. at Research Enterprises Ltd. and Inspection Bd. U.K. & Can., Toronto. (St. 1938.)

References: C. A. Robb, R. W. Boyle, E. G. Cullwick, R. C. Wallace, W. E Phillips.

JARRETT—WILLIAM FREDERICK, of Isle Maligne, Que. Born at Kenora, Ont., Aug. 8th, 1916. Educ.: B.Sc. (Elec.), Univ. of Man. 1939; 1939-41, dftsman. and asst. dispatcher, Manitoba Power Commission; 1941-43, dftsman. and designer, wiring and bus layout, Aluminum Co. of Can.; 1943 to date, elect. engr., Saguenay Power Co., powerhouse at Isle Maligne, Que. (St. 1938.)

References: J. E. Thicke, H. R. Fee, F. L. Lawton, E. P. Fetherstonhaugh, G. H. Herriot.

MACNAB—EDWARD NELSON, Lieut. (E), R.C.N.V.R., of 137 Strathearn Ave., Montreal West. Born at Montreal, Aug. 10th, 1919. Educ.: B.Sc. (Elect.), Univ. of N.B., 1943; with R.C.N.V.R. as follows: Directorate of Naval Stores, Ottawa, 2 mos., 1943; 1943-44, Flotilla elec. officer to the 262nd L.C.I. (large); 1944 to date, with elec. staff of Chief Engr., Newfoundland Command. (St. 1942.)

References: E. O. Turner, A. F. Baird, D. R. Smith, T. C. Macnabb, L. A. Wright.

McNALLY—REGINALD WINNETT, of Port Hope, Ont. Born at Regina, Sask., May 13th, 1916. Educ.: B.Sc. (Mech.), Univ. of Sask., 1942; 1942-44, Lieut., E.M.E., with R.C.E.M.E., C.A.O.S., i/c tank section of w'kshop; 1944 to Feb. 1945, engr. dftsmn., City Engineer Dept., Regina, Sask.; at present detail and design engr., Mathews Conveyer Co., Port Hope, Ont. (St. 1942.)

References: G. W. Parkinson, N. B. Hutcheon, R. A. Spencer, I. M. Fraser, F. C. Christie, D. A. R. McCannel.

MITCHELL—E. ROE, Capt., R.C.E.M.E., of 115 Kensington Ave. N., Hamilton, Ont. Born at Listowel, Ont., July 31st, 1918. Educ.: B.Sc. (Mech.), Queen's Univ., 1940; 1940-42, engr. ap'tce. (mech.), Canadian Westinghouse Ltd., Hamilton; with R.C.E.M.E. as follows: 1942-44, Lieut. E.M.E., and 1944 to date, Capt., mtce. and repair of Fire Control instrumts. for Military Dists. 10, 12 and 13. (St. 1939.)

References: H. J. G. McLean, W. R. Craig, D. S. Ellis, L. T. Rutledge, D. W. Callander.

MITCHELL—JOHN HUGH, of Hamilton, Ont. Born at Regina, Sask., Feb. 5th, 1917. Educ.: B.Sc. (Mech.), Univ. of Sask., 1941; 1941-43, engr. ap'tce., Canadian Westinghouse Co.; 1943-44, engr. in mech. engrg. divn. of Can. Westinghouse; 1944 to date, Refrigeration Engr. in Appliance Divn. of Engrg. Dept., Can. Westinghouse, Hamilton. (St. 1940.)

References: E. M. Coles, D. W. Callander, L. C. Sentance, H. O. Peeling, H. Thomasson.

MULLEN—THOMAS JAMES, Jr., of Chicago, Ill. Born at Westmount, Que., Oct. 9th, 1911. Educ. B.Eng. (Mech.), McGill Univ., 1934; with B. F. Sturtevant Co., as follows: 1934-35, student engr. at Boston; 1935-36, sales engr. at Washington; 1936-37, dist. mgr., Richmond, Va.; 1937 (6 mo.), engr. at Greensboro, N.C.; 1937-38, engr. at Boston; 1938 (10 mo.), industrial engr. at Boston; 1939-40, dist. mgr. at Milwaukee; 1940-41, engr. at Chicago; 1940 to date, industrial mgr., Western Division, i/c thirteen factory branch offices. (St. 1933.)

References: E. Brown, R. DeL. French, C. M. McKergow, G. R. Rinfret, J. Stadler, B. R. Perry, W. L. Hutchison, C. R. Lindsey, O. R. Brumell.

REID—JAMES MacPHERSON, of 1589 Hall Ave., Windsor, Ont. Born at Toronto, Ont., Aug. 1st, 1921. Educ.: Bach of Mech. Engrg., Lawrence Inst. of Tech., 1945; 1940-43, ap'tce. tool and die maker, Ford Trade School; 1943 to date, mech. engr. equipmt. layout and design and field supvsn., Engrg. Dept., Ford Motor Co. (St. 1944.)

References: J. B. Dowler, J. F. Blowey, E. Chorolsky, G. W. Lusby, H. Lillie.

RULE—RUSSELL A., Major, R.C.E., of Ottawa, Ont. Born at Toronto, Ont., May 2nd, 1916. Educ.: B.A.Sc. (Civil), Univ. of Toronto, 1939; with Storms Contracting Co. as follows: 1935-38 (summers); 1939-42 as foreman, asst. supt. and then supt. on airport and highway constrn. work; 1942 to date, with R.C.E., in Directorate of Works and Constrn., N.D.H.Q., Ottawa, as 2/Lt., Lieut., and at present, Major. (St. 1939.)

References: H. L. Layman, W. H. Blake, R. F. Leggett, D. Blair, B. MacCarthey.

RUSSELL—HAROLD GEORGE, of 2358 Grand Blvd., Montreal. Born at Montreal, May 7th, 1918. Educ.: B.Eng. (Chem.), McGill Univ., 1940; 1940-43, group mgr., high explosive filling group, Can. Car Munitions, Cherrier, Que.; 1943 to date, refinery process engr., Bahrein Petroleum Co., Bahrein Island, Persian Gulf. (St. 1940.)

References: R. DeL. French, J. B. Phillips, C. M. McKergow, G. H. Kirby, L. A. Wright.

SMITH—ALLEN CEDRIC, of Calgary, Alta. Born at Edmonton, Alta., Oct. 20th, 1917. Educ.: B.Sc. (Civil) Univ. of Alta., 1942; 1942-43, asst. to rlwy. supt., Demerara Bauxite Co., Mackenzie, British Guiana; 1943-44, asst. on plant constrn., Aluminum Co. of Can., Beauharnois; 1944-45, asst. plant engr., Commonwealth Plywood Co. Ltd., St. Therese, Que.; at present, chief engr., Rlwy. Divn., Fred Mannix Co., Calgary. (St. 1941.)

References: R. W. Ross, H. W. Tye, C. J. L. Sanderson, E. S. Holloway, J. W. Ward.

WHITE—CLIFFORD HUBERT, Elect. Lieut., R.C.N.V.R., of 91 Fourth Ave., Ottawa, Ont. Born at Souris, Man., Feb. 25th, 1916. Educ.: B.Sc. (Elec.), Univ. of Man., 1938; 1938-40, student ap'tce., and 1940-41, sales engr., C. A. Parsons & Co., Newcastle-on-Tyne, England; 1941-44, elec. mfg. overseer, R.C.N., and 1944 to date, member, Prodn. and Engrg. Group, Directorate of Elect. Engrg., Naval Service H.Q., Ottawa. (St. 1938.)

References: F. J. Bell, E. G. Cullwick, E. P. Fetherstonhaugh, N. M. Hall, B. Ottewell, F. R. Pope.

Employment Service Bureau

NOTICE

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 is—

(a) unemployed;

(b) 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

GRADUATE CIVIL OR MECHANICAL ENGINEER wanted. See page 64 of the advertising section.

MECHANICAL ENGINEER DRAUGHTSMEN wanted. See page 66 of the advertising section.

SALES ENGINEER wanted. See page 66 of the advertising section.

ENGINEERING STAFF required. See page 66 of the advertising section.

CHEMICAL, MECHANICAL, CIVIL ENGINEERS wanted. See page 68 of the advertising section.

STRUCTURAL ENGINEER wanted. See page 68 of the advertising section.

DRAUGHTSMEN AND ENGINEERS, Mechanical, electrical and concrete draughtsmen and designers wanted by pulp and paper company. Apply to Box No. 2890-V.

Rehabilitation Employment

The Engineering Institute has established a department with the sole object of providing a rehabilitation service to members in uniform.

This department is now in operation and it is the intention to develop it to the point where it can render really valuable assistance to returning members. To this end a special committee has been established known as the Advisory Committee on Rehabilitation, under the chairmanship of Major-General Howard Kennedy.

A letter and questionnaire were sent in March to all members in the services, and already one hundred and fifty replies have been received. They indicate that the service can be of assistance to about two-thirds of the total. For this reason, it would be of great value to the committee, and therefore, to the returning members, if employers would inform the Institute of their probable post-war requirements.

It is appreciated that most firms have a comprehensive rehabilitation scheme for their own returning personnel. Naturally such proposals take precedence over all others but it is still hoped that there will be openings for the large number of returning members who will not have such advantages. All employers will be familiar with the work of the Wartime Bureau of Technical Personnel. The Institute service is not intended to replace this but rather to give to members an additional service on behalf of their fellow members, which it is believed will aid materially in assimilating them into civilian life.

It would facilitate the work of the committee if employers would furnish details of possible vacancies including:

1. Nature of work
2. Temporary or permanent
3. Salary range
4. Location
5. Experience required
6. Must position be filled immediately or can it wait for post-hostility discharge of candidate?

With this information, negotiations can be started now that should work out eventually to the advantage of everyone.

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. 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. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.

ELECTRICAL SALES ENGINEER for western firm specializing in engineering sales and service of all types of electric machinery and similar equipment. The position would be permanent and on a salary basis. Applicants should state: training, experience, age, nationality and availability. Apply to Box No. 2911-V.

GRADUATE MECHANICAL ENGINEER about thirty for a well-established concern engineering and manufacturing conveying equipment in their own plant. A working knowledge of mechanics and light structural steel, along with the aptitude for applying same, also the desire to learn the conveying business from the ground up is essential. This is a permanent position for the right man. Apply to Box No. 2942-V.

SITUATIONS WANTED

ELECTRICAL ENGINEER, M.E.I.C., age 38, B.Sc. McGill. Widespread experience on electrical maintenance, radio and telephone engineering. Five years with the R.C.A.F. in the aeronautical engineering branch specializing on electrical work. Immediate experience before joining the R.C.A.F. was four years on electrical maintenance in paper mills, including experience with Harland and General Electric drives. Interested in maintenance, development or layout design of electrical equipment. Not available until release from the R.C.A.F. but wishes to make contacts for a post-war position. Apply to Box No. 12-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., with 18 years' experience in iron industry; machine tools, steel cabinets, conveyors, etc., light metal and food processing industry, has held executive positions in charge of production, industrial engineering, designing, buying, selling, financing. An expert in cost accounting and lighting, a man with good ideas, tact, initiative and sound technical judgment, available immediately. Age 41, married, Canadian bilingual. Apply to Box No. 1730-W.

CHEMICAL ENGINEER, seven years' experience on production and inventory control; distillation, solvents, analysis. Available under W.B.T.P. regulations. Now residing in Montreal. Apply to Box No. 1827-W.

ENGINEER, M.E.I.C., R.P.E.(Ont.), presently employed as assistant engineer and chief draughtsman. Desires new connection due to contemplated staff reduction in a war industry. Extensive experience in structural steel and plate fabrication miscellaneous builders' iron work and reinforced concrete as engineer and draughtsman, estimating and sales. Apply to Box No. 2208-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., R.P.E. (Ont.) 35 years of age, 10 years' general contracting experience; 6 years sales engineering and executive experience with manufacturer of construction materials. At present holding commission in R.C.A.F. Works and Buildings branch, desires contacts in construction field for employment in near future. Apply to Box No. 2471-W.

GRADUATE ENGINEER, M.E.I.C., R.P.E. (N.B.) with 30 years practical experience in design and construction of industrial plants, reinforced concrete, steel, timber, steam heating, water supply installation, sewerage, wharves and docking facilities, quantity and cost estimates. At present holding position of responsibility, seeks position of responsibility with industries which contemplate building or expanding. Apply to Box No. 2472-W.

CIVIL ENGINEER, executive, M.E.I.C., recently completed tropical contract, seeks new connection Canada or abroad. Twenty-five years' engineering and executive experience. Clean record and best of references. Available immediately. Apply to Box No. 2474-W.

CIVIL ENGINEER, M.E.I.C., R.P.E.(Ont.), B.A.Sc., Toronto. Resident for past 12 years in U.S., New York, desires to return permanently to Canada. Thirty-two years' experience on design and construction of harbour works, piers, dry docks, quay walls, cofferdams, foundations, steel and concrete buildings. Specialist steel sheet piling, railway location and construction. Public utility appraisals, industrial engineering, sales engineering and promotional work including export sales, journalistic and advertising work. Foreign experience in China, West Indies, Alaska. Good organizer and executive. World War I veteran. Seeking administrative or supervisory opening or sound sales or business opening. Willing to travel. Apply to box No. 2476-W.

MECHANICAL ENGINEER, 41 with 17 years' experience in machine shop, production of precision parts, internal combustion engines, tool design, seeks responsible position; will consider association with reputable consulting engineers. Apply to Box No. 2480-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., age 35, married, 6 years general office experience, 4½ years on maintenance, inspection and construction in oil refinery, 3 years supervising construction in tropics, 1½ years on structural steel and reinforced concrete design, piping and plant layouts. Desires field position, preferably on construction work. Location immaterial. Registered with W.B.T.P. and available May 1st. Apply to Box No. 2481-W.

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

COVER PICTURE

This cover picture is dedicated to the construction industry of Canada. (*Photograph by Max Sauer.*)

SOIL MECHANICS AS APPLIED TO P.F.R.A. PROBLEMS WITH SPECIAL REFERENCE TO THE PROPOSED ST. MARY DAM

ROBERT PETERSON, Jr.E.I.C.
Soil Mechanics Engineer, P.F.R.A., Saskatoon, Sask.

Paper presented at the Fifty-Ninth Annual General Professional Meeting of The Engineering Institute of Canada, at Winnipeg, Manitoba, on February 8th, 1945.

SUMMARY—This paper deals briefly with the soils investigation in connection with P.F.R.A. water development projects and covers the progress to date on the proposed St. Mary dam. The field and laboratory work for this dam are not described in detail, but rather the typical results of laboratory tests are given and these results are then applied to the design.

Introduction

Since the inception of the Prairie Farm Rehabilitation Administration (P.F.R.A.) in 1935, greater emphasis has been placed on a complete soil mechanics investigation of its engineering projects previous to construction. Consequently, a soil mechanics department has been gradually built up by acquiring the necessary field and laboratory apparatus. The standard field equipment consists of a truck-mounted rotary drilling machine (Fig. 1), a hand operated wash boring outfit, and various tools necessary to recover samples and determine the characteristics of soils in place.[1]

In addition to that required for routine classification tests, the following laboratory apparatus is in use: a direct shear machine, consolidation devices, triaxial shear machines, and equipment for both the Proctor and California methods of compaction.[2, 3]

In the investigation of a project, the preliminary examination of surface indications will give a trained observer some idea of the nature of the underlying soil. On the basis of this information, a tentative drilling and sampling programme is commenced which is modified and extended to obtain complete information on foundation and construction materials in the vicinity of the structure. While the drilling is being carried on in the field, the samples and the drilling logs are, at intervals, forwarded to the Soil Mechanics Laboratory located at the University of Saskatchewan. The routine classification tests are performed on representative samples of all soils received, but the number and type of tests to determine the physical properties are governed by the use for which the soil is intended in the structure. Considering the classification and general properties of the soil, a design is conceived, which is then checked by applying the soil test results in the various analyses.

Proposed St. Mary Dam

General

It is proposed by P.F.R.A. to construct a dam on the St. Mary river, near Spring Coulee, Alberta, to store water for the purpose of irrigation in the area south and east of Lethbridge. The required height of dam is 186 ft. and, for this height, the crest length would be about 2500 ft. and the length at the base, across the streambed, approximately 300 ft. A diversion conduit through the fill or a tunnel bypassing it will be necessary to divert the river during construction. Water for irrigation purposes will likely be taken from the reservoir by a tunnel, located about 90 ft. above the streambed, which will pass through the ridge that forms the south-east abutment of the dam. It is planned to provide spillway capacity by cutting down natural coulees around the north end of the dam.

A rolled fill earth dam was originally suggested, and subsequent investigations have indicated this to be the best and cheapest type for this site. The foundation bedrock has been explored with drill holes and the surface of the rock located beneath the proposed fill. Sources known to have sufficient quantities of both pervious and impervious soil for the dam have been located and samples taken. The samples from these proposed borrow pits have been tested and the results applied to the design of the fill section.

When the original cross-section was drawn up, it was planned to build a homogeneous fill consisting almost entirely of impervious glacial clay. This was reasonable at the time because it was known that enough clay to build the entire dam, consisting of approximately 3½ million cu. yd., was easily available, although little was known on the properties of this soil. The subsequent soil tests indicated that the impervious soil was not ideal for a homogeneous fill of the proposed height; consequently, the design was modified and pervious sections added. The dimensions of these pervious sections were kept to a minimum because of the comparatively high cost of sand, gravel, and rock. The resulting modified section is illustrated in Fig. 2. At the present time, although this section has been more or less adopted, there is some question about the type

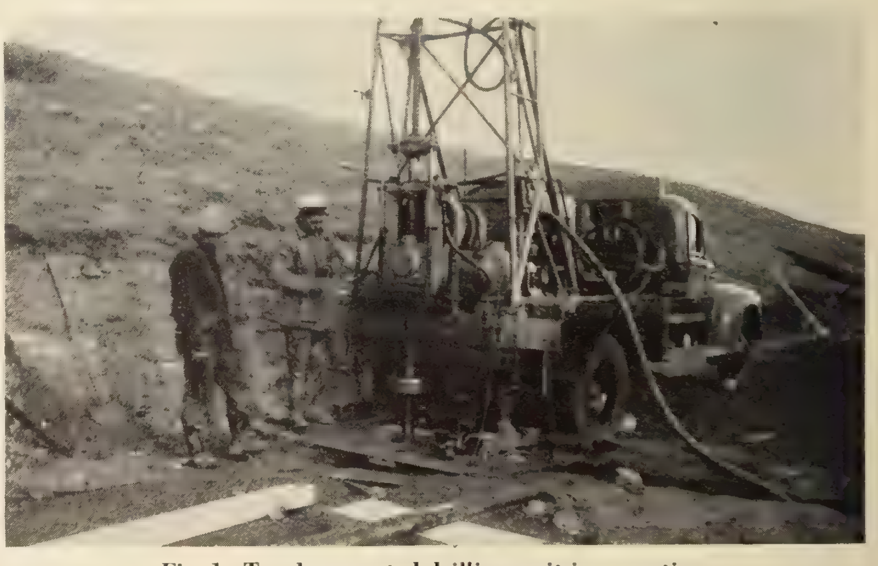


Fig. 1—Truck-mounted drilling unit in operation.

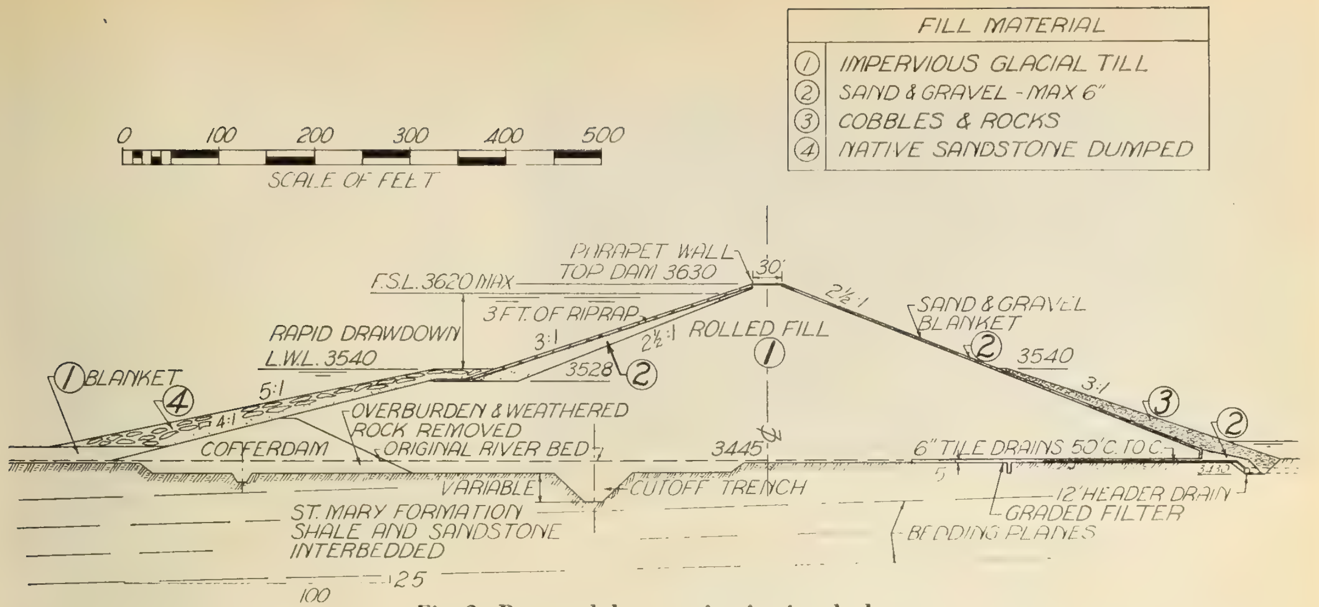


Fig. 2—Proposed dam section in river bed.

of compaction equipment required in the field to get sufficiently high densities in the impervious soil to assure the stability of the side slopes.

Field Investigation

Preliminary field work was carried on in 1939, and a thorough investigation of foundation and fill material was begun in 1941 under the direction of W. L. Foss, M.E.I.C., District Engineer in charge of the project, and the author. Dr. J. A. Allan, M.E.I.C., Consulting Geologist, inspected the site and advised as to the most advantageous location of drill holes. The greater part of the drilling and sampling was completed in 1942 but since then it has been necessary, on several occasions, to get additional samples and detailed information in the vicinity of structures as the design has developed.

The foundation exploration was carried out almost entirely by diamond drilling. However, some use was made of washboring and testpits to locate the position of the rock line and determine the condition of the weathered bedrock below its line of contact with the soil overburden. Diamond drill holes were spaced at intervals along the centreline and at other points beneath the fill where they seemed necessary—particularly in the streambed. Holes were also put down along the centrelines of proposed tunnels and at points where structures were to be located. The locations of diamond drill holes No. 8 to No. 19 are shown in a photograph (Fig. 3) that was taken looking downstream towards the centreline—indicated by a broken line. The following distances will aid in studying this photograph: Hole No. 9 to No. 13: 290 ft. (width of streambed), Hole No. 12 to No. 14: 670 ft., and difference in elevation between Hole No. 8 and No. 19: 90 ft. Figure 4 shows the northwest bank of the damsite looking along the centreline. In all, 43 diamond drill holes were put down, varying in depth from 30 to 220 ft., and giving a total footage of over 3000 ft.

With the exception of the preliminary drilling, where only a small diameter core was obtained, a 2-in. core was recovered from all the diamond drill holes. The cores were placed in boxes of the type shown in Fig. 5 which were clearly marked to form a permanent record of the bedrock drilled through. When the drilling was completed, Dr. Allan examined the cores and on the basis of this inspection and the field drilling notes, he prepared logs of all holes. The cores are now in storage and can be examined by engineers and contractors as the need arises. The longest solid piece of core recovered was 5 ft. 10 in. in length and is shown in Fig. 6.

The foundation investigation indicated that bedrock, consisting of interbedded shale and sandstone, was overlain by varying depths of unconsolidated material. The dip of the rock strata was approximately 2.5 per cent in the upstream direction. In the streambed, bedrock outcropped below the centreline and along the edges, whereas in the central portion above the centreline, as much as 10 ft. of sand, gravel and disintegrated bedrock was found. On the banks, the bedrock was overlain by silt adjacent to the river bed, and by silty glacial clay at higher elevations and farther from the river. The depth of this overburden varied from zero to a maximum of 40 ft.

Permeability tests were made on the diamond drill holes by filling each completed hole with water and observing the time required for the water level in the hole to reach the ground water table. The results showed

Fig. 3—St. Mary damsite looking downstream towards centreline.

Fig. 4—North bank of site looking along centreline.

that the top portion of the bedrock was quite pervious but that the rock became more impervious with depth. This, of course, was to be expected because, in every hole, weathered and fractured bedrock was found for some distance below the contact with the overburden.

Dr. Allan describes the bedrock formation as follows:[4]

"The St. Mary River formation is of continental and fresh-water deposition. The rocks consist of an intimately interbedded thick series of buff to grey sandstones, clayey sandstones, calcareous sandstones, buff, grey and greenish grey shales, sandy shales and thin bands of carbonaceous shale and clayey shales. This alternating series of sandstones and shales grades one into the other. The sandstones are lenticular and only thin beds of massive sandstone occur. The shales are soft and friable and are poorly bedded. It is not possible to correlate any particular bed for any distance between diamond drill holes or on the outcrop. This is a good feature, because the strength of the rock is increased by this variable character of the sediment. No continuous unstable bed of uniform material over any large area has been observed. On the other hand, there are no prominent beds of hard or strong strata in this area.

"It must be understood that all the strata in the St. Mary River formation under the proposed dam are soft and are quickly weathered when exposed to the air. But if protected from air and water they are as durable as many rocks in older formations."

Preliminary work had indicated that the best source of impervious soil for the fill was from the high ground immediately north of the site. Consequently, this area was explored in detail and additional drilling was done in the vicinity to make certain that no other source had been overlooked in the original survey. The extent and depth of the soil in this area was determined by about 25 auger and wash bore holes, which varied in depth from 10 to 43 ft. The purpose of these holes was to determine the quantity of material available and to get small samples for soil classification tests. The soil was found to be a silty glacial clay, and laboratory classification tests indicated no appreciable variations from hole to hole and only slight variations with depth. Consequently, two testpits were dug to obtain large samples for testing purposes. It was found that at least 4 million cu. yd. of glacial clay would be available in the area outlined by drilling if excavated to a maximum depth of 31 ft. With the exception of the topsoil, all the material appeared suitable for a rolled fill dam. Although the material was very well graded, it did not contain a high percentage of sand and gravel and was quite plastic.

A search for pervious fill material failed to reveal a sufficient amount in the immediate vicinity, but considerable quantities of sand and gravel were located along the river bed at distances varying from 3 to 10 miles from the damsite. It was roughly estimated on the basis of a few testpits at each deposit that at least 400,000 cu. yd. will be available. This is sufficient for the present proposed design. Samples of the sand and gravel were taken with a view toward using it for both pervious fill and concrete aggregate.

It was evident that suitable large aggregate for rock toes and boulders for riprap were rather scarce. With regard to using the native sandstone for riprap, Dr. Allan pointed out that it is rather weakly cemented and therefore may not stand up to weathering. It may be possible, however, to use the harder varieties in the rock sections, but the placing of sandstone for riprap has been definitely eliminated. Small quantities of field stone and boulders strewn along the river were the only other sources of rock in the vicinity. Thus it became apparent that the bulk of the riprap might have to be imported.

The results of the field work seemed to indicate that the site was suitable for an earth dam of the required height. Although the foundation bedrock was thinly bedded, contained some soft layers, and was cracked and broken near the surface, it appeared that the removal of the undesirable material would expose a satisfactory foundation. A sufficient quantity of glacial clay was available at the site to construct the entire dam of this soil if tests showed it to be stable with reasonable side slopes. A limited quantity of sand and gravel was located but the haul was rather long. This fact would tend to favour a homogeneous earth section built entirely of the glacial clay.

Laboratory Soil Tests

In this section the tests on the glacial clay only will be considered, because it was obvious from the beginning that this material rather than the sand, gravel or bedrock would present the greatest problems from the soil engineering viewpoint. The detailed laboratory pro-

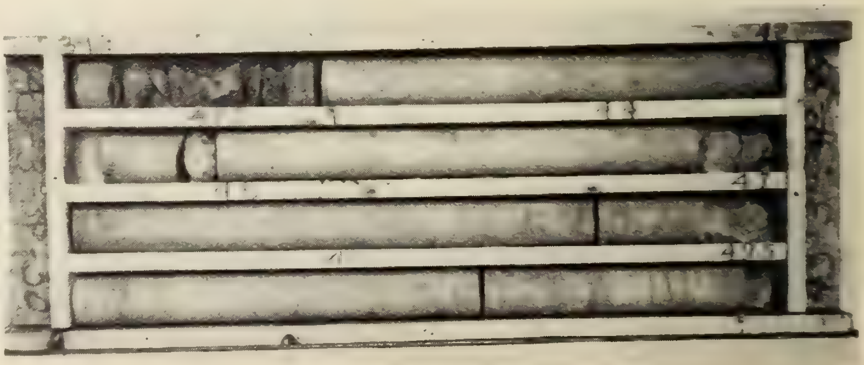


Fig. 5—Box of rock cores.

cedures for the soil tests have not been given but may be found in A.S.T.M. Standards. The results of the routine classification tests have been tabulated and sufficient detail given on the physical tests, especially compaction tests, to show the significance of the results and their place in the design analyses.

When referring to soil densities, unless otherwise specified, the wet weight in lb. per cu. ft. has been given. The water content in every case has been indicated as a percentage of the dry weight.

(a) Classification Tests

Field classification—silty glacial clay (glacial till)
Specific gravity of soil solids, average—2.71
Percentage of soluble solids, average—0.18
Water content in borrow pit—
Minimum—6.0% Maximum—15.0%
Density in borrow pit, average—118 lb. per cu. ft.
Liquid limit, average—35.3
Plastic limit, average—14.5
Plasticity index, average—20.8
Shrinkage limit, average—9.9.
Public Roads Soil Group—A-6-4

In Fig. 7 are shown the limits of grain size for both impervious and pervious materials; in both cases the limits given include the range of all the samples tested.

(b) Compaction Tests

The density required to ensure the stability of the glacial clay is the most important single consideration in the design studies of the proposed St. Mary dam; therefore, the compaction tests will be covered in detail.

The purpose of a compaction test is to determine not only the maximum density which will result for some particular degree of compaction, but also the water content at which this density can be attained with the least amount of work. The usual procedure is to begin with the soil dry and compact a sample using the chosen method of compaction. The water content at which this sample is compacted and the resulting density are then determined; this data gives one point on a curve which is eventually plotted showing the relationship between density and water content. To complete the curve, additional points are determined by adding moisture and recompacting the soil at the increased water contents. The water content at which

Fig. 6—Sandstone core from St. Mary damsite.

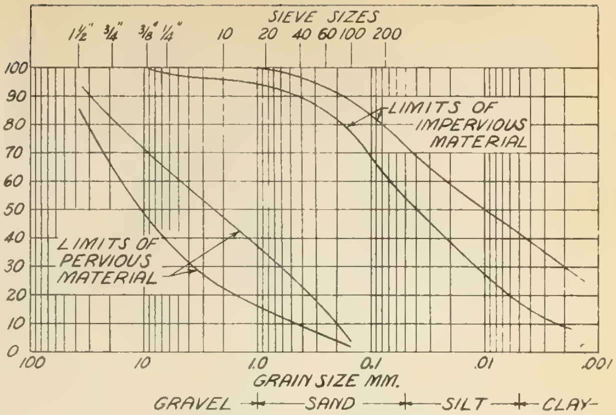


Fig. 7—Grain size curves showing limits of pervious and impervious materials.

the greatest density occurs, as indicated by the curve, is known as the optimum moisture content for that particular degree of compaction. It must be understood that both the optimum moisture content and the maximum density vary with the degree of compaction for any one soil. As the compaction and resulting density increase the optimum moisture content decreases.

For the St. Mary clay, laboratory tests were performed using five different types of compaction. The curves were determined in the same manner but the methods of compaction varied as follows:

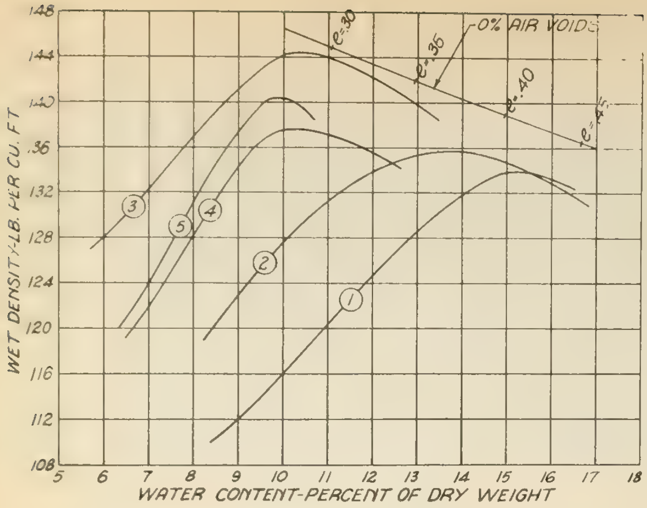
The first method, which has been used in most laboratories, is known as Proctor's method.[2] It consists of compacting the soil in 3 layers into a cylinder whose volume is one-thirtieth of a cu. ft. Each layer is compacted by 25 blows of a 5.5 lb. tamper dropping a distance of 12 in.

The second method is a modification of the first; 25 blows of the same tamper are applied to each layer but the height of drop is increased from 12 to 18 in. This type of test is used by the United States Bureau of Reclamation (B. of R.) laboratories.[5]

The third type of compaction is obtained by using a static pressure of 2000 lb. per sq. in. on the soil in a similar cylinder rather than by the impact from a hammer. This was developed by O. J. Porter, Senior Testing Engineer, of the California Department of Highways.[3] It gives a higher density and lower optimum moisture content than either of the previous tests. Hereafter this test will be referred to as the California Method.

The fourth and fifth types are known as laboratory sheepsfoot compaction tests. The soil is compacted in a cylinder 12 in. in diameter and 10 in. deep, by a 3 in. diameter shaft which simulates the effect produced by a sheepsfoot roller. In one case a pressure of 500 lb. per sq. in. is used to force the foot into the soil whereas 1000 lb. per sq. in. is used in the other. In both cases the soil is tamped by the required number of penetrations to give complete coverage of the surface area.

The curves resulting from the previously described tests have been plotted in Fig. 8 and are self explanatory. The theoretical line of zero per cent air voids indicates that samples at these densities and corresponding water contents are completely saturated with water. The samples which were compacted did not reach complete saturation because of entrapped air; however, with the California Method almost complete saturation was obtained. It will be noted that curve No. 1, Proctor with 12 in. drop, shows a density of 134 lb. per cu. ft. at an optimum of 15.5 per cent of moisture; whereas, curve No. 3 of the California



1 STANDARD PROCTOR COMPACTION - 12" DROP
2 STANDARD PROCTOR COMPACTION - 18" DROP
3 CALIFORNIA COMPACTION - STATIC LOAD 2000 P.S.I.
4 LABORATORY SHEEPSFOOT COMPACTION - 102% COVERAGE
FOOT PRESSURE 500 P.S.I.
5 FOOT PRESSURE 1000 P.S.I.

Fig. 8—Compaction curves.

Method indicates a density of 144.5 lb. per cu. ft. at a water content of 10.5 per cent. It was originally thought that curve No. 1 would give a satisfactory density in the earth fill but it is now felt that a wet weight approaching that of curve No. 3 will be required for reasons to be explained later.

In an attempt to arrive at the design of a sheepsfoot roller which would produce densities corresponding to the California compaction, tests No. 4 and No. 5 were carried out. These indicated that a foot pressure of 1000 lb. per sq. in. will give almost the required density. It is believed that if the test were performed in the field with an actual roller where impact would increase the compacting force, the densities would be higher than those given by curve No. 5.

In Fig. 9(a) and (b) compaction statistics are reproduced (Figs. XV to XIX inclusive) with the kind permission of O. S. Harper, Chief Engineeer, U.S.B. of R., Denver, Colorado.[5] All the curves are for the Platte River Embankment material and in every case the dry density has been given.

In Fig. XIX is shown the effect of the number of blows on the density-water content curves for a soil compacted with the Proctor method and the 18 in. drop of the tamper. The number of blows was varied from 5 to 40 per layer; the standard number being 25. It will be noted that these tests were performed on the soil fraction passing the ¼ in. screen. In Fig. XVIII similar curves were determined for the whole sample including the material coarser than the ¼ in. screen.

Figs. XV, XVI, and XVII deal with sheepsfoot tests on the entire sample. Fig. XVI illustrates the pattern in which the sheepsfoot was used for the various coverages. In Fig. XV is shown the effect of coverage, which is defined in the figure, on the maximum compacted density and the optimum moisture content with a constant foot pressure of 200 lb. per sq. in. The coverage was varied from zero up to 200 per cent and the thickness of the compacted layers was 6 in. With a constant coverage of 50 per cent (Fig. XVII), the compacting pressure was varied from zero to 500 lb. per sq. in. by increments of 50 lb. per sq. in., and the variations in optimum moisture content and density determined.

The results of Figs. XVIII, XV, and XVII have been compared to study the relation between the Proctor compaction, with the 18 in. drop, and the unit pressure and coverage required of a sheepsfoot roller in the field. It has been kept in mind, however, that this relation applies to one particular soil and that it may vary considerably with the soil type.

(c) Shear Tests

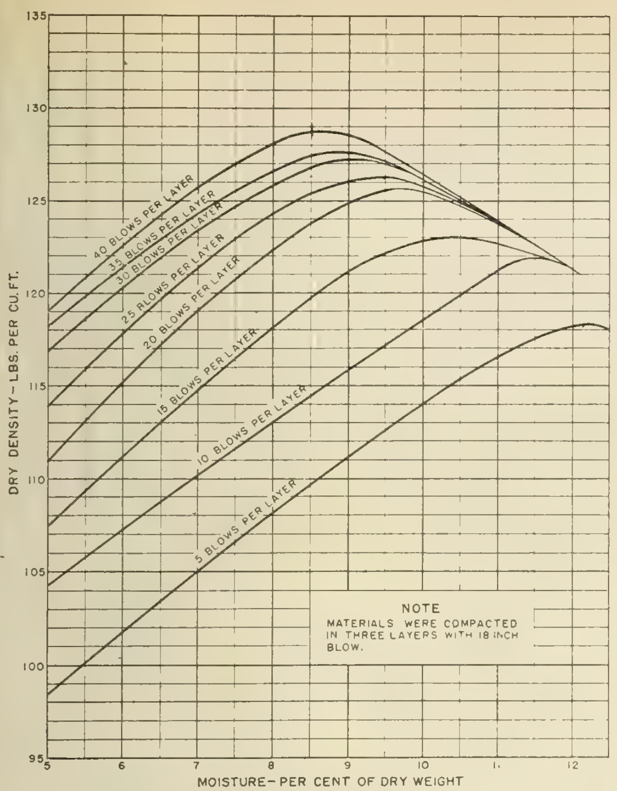
The unit shearing strength (S) of a soil, as given by Coulomb's equation, is made up of two parts, the cohesion (C) and the internal friction, $P \tan \phi$, where P is the normal unit stress on the failure plane and ϕ is the angle of internal friction.

$$S = C + P \tan \phi$$

For sands and gravels, C is generally equal to zero and the shearing strength is made up entirely of internal friction; whereas, for clays and mixtures containing clay, the shearing resistance is made up of both cohesion and internal friction. The angle of internal friction, ϕ, of cohesionless soils, varies with the density for different samples of the same material. In the case of clays the angle of internal friction varies not only with the density, but also with the water content, rate of load application and other factors. It is a known fact that, for some types of clay, a sudden application of load will give a ϕ very nearly zero and that a slow application of load, which would allow consolidation under each increment, would give a ϕ of 30 deg. Therefore, when attempting to determine the cohesion and angle of internal friction for clays, an effort must be made to adopt a testing procedure which will simulate loading conditions in the field. If the soil in the structure is to be loaded rapidly, a "quick test" should be used in the laboratory. In this type of test, the load should be applied at such a rate that failure of the sample will take place in about 10 minutes.

The cohesion and angle of internal friction of the St. Mary glacial clay were determined for water contents and densities corresponding to both the Proctor and California compaction, by two types of shear tests.[2] The first was the direct shear test in which the actual force to produce failure on a shear plane through the soil specimen was measured at varying normal unit stresses (P). The second was the triaxial shear test in which a cylindrical sample was loaded to failure and the shearing stress (S), and the normal stress (P) were determined on the rupture plane by applying Mohr's stress circles.[6] The triaxial test is similar to the ordinary cylindrical compression test except that failure is produced by both axial and lateral loadings. The sample is enclosed in a rubber membrane and the lateral load is applied to its circumferential surface by a hydrostatic pressure; the vertical load is then increased until rupture occurs. A clearer picture will be had after studying Fig. 10 which shows soil specimens which have been tested in shear by both methods. The triaxial sample shown on the left was 2.8 in. in diameter and 8 in. high prior to testing, and the failure plane can be seen cutting diagonally through its upper portion. The two small samples on the right are direct shear specimens and are 2.5 in. in diameter and 1 in. high. The failure plane through the sample at the extreme right is clearly visible about mid-height, whereas the centre specimen has not been tested.

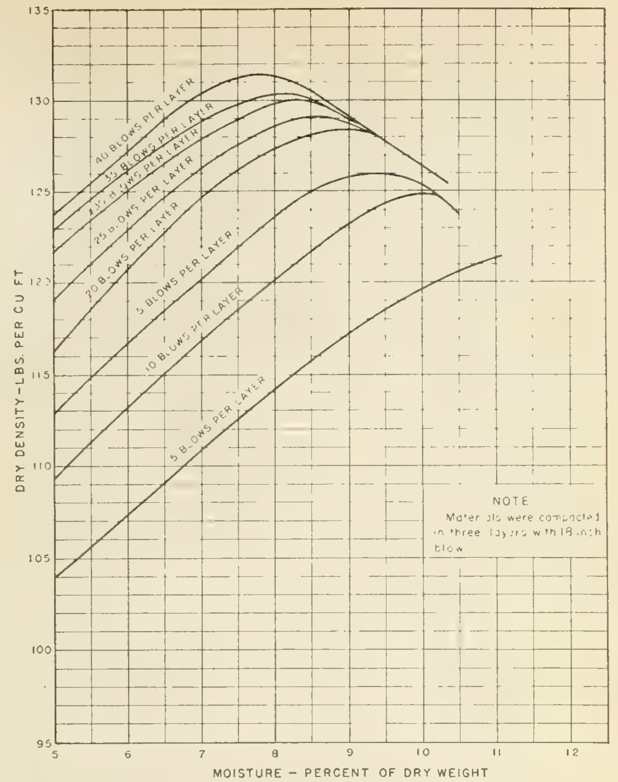
The average results of the shear tests have been plotted in Fig. 11, where the densities and water contents of the samples tested are also given. Curves No. 1 and No. 2 are for the direct shear and triaxial respectively, at the Proctor density. Similarly, curves No. 3 and No. 4 are for a density nearly equal to the Cali-



IMPACT METHOD OF COMPACTION IN SMALL CYLINDER FOR MATERIALS SCREENED THROUGH $\frac{1}{4}$ INCH MESH SCREEN FOR COMPARISON WITH FIGURE XVIII

PLATTE RIVER EMBANKMENT MATERIAL

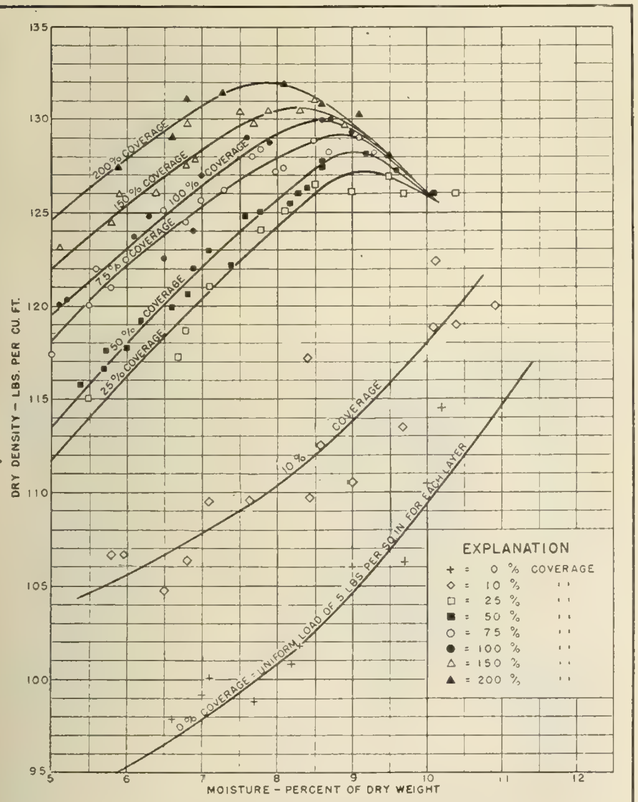
FIGURE XIX X-D-1871



IMPACT METHOD OF COMPACTION IN SMALL CYLINDER FOR COMPARISON WITH FIGURES XV AND XVII

PLATTE RIVER EMBANKMENT MATERIAL

FIGURE XVIII XD 1820



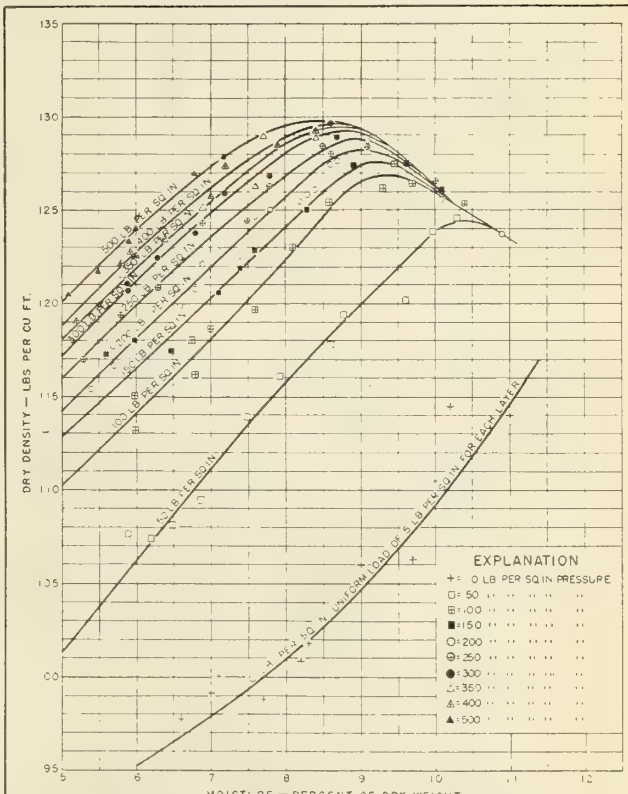
NOTE — % Coverage = $\frac{\text{No. of Applications} \times \text{Area of Sheepsfoot}}{\text{Area of Cylinder}} \times 100$

SHEEPSFOOT COMPACTION TEST

PLATTE RIVER EMBANKMENT MATERIAL

EFFECT OF COVERAGE AT 200 LBS PER SQ IN COMPACTING LOAD

FIGURE XV XD 1821



SHEEPSFOOT COMPACTION TEST

PLATTE RIVER EMBANKMENT MATERIAL

EFFECT OF PRESSURE AT 50% COVERAGE

FIGURE XVII XD 1822

Fig 9 (a)—Data from U.S. B. of R. compaction studies.

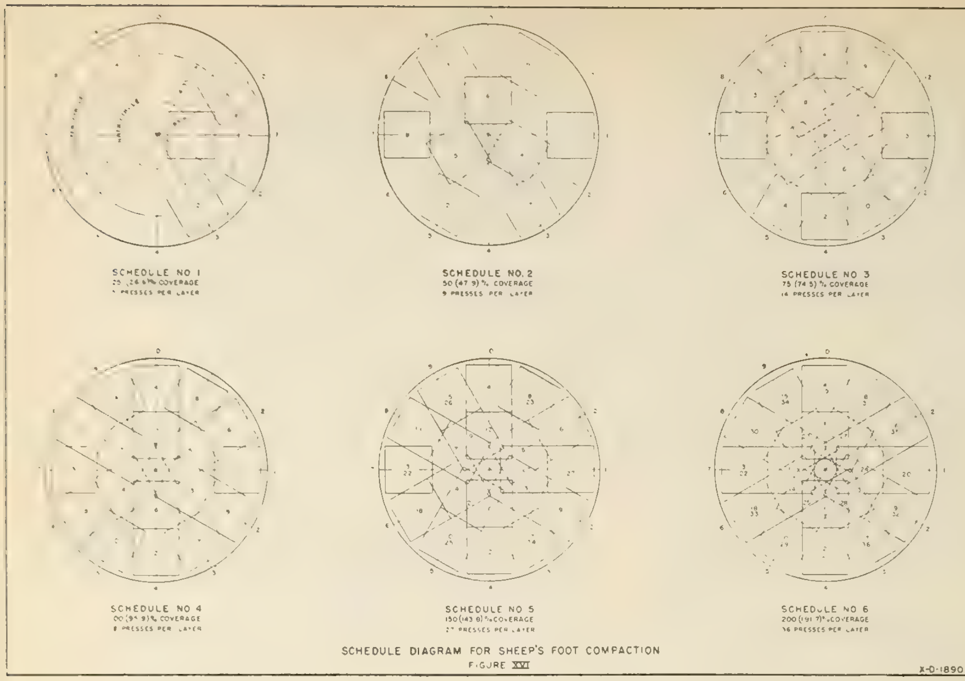


Fig. 9 (b)—Data from U.S. B. of R. compaction studies.

fornia. Theoretically, the direct shear and triaxial should give the same results, provided of course that the samples were at the same density and at the same water content. The values from the direct shear are higher than those by the triaxial. This is due in part to the fact that the direct shear samples were drier than the triaxial samples in both cases. For purposes of design, the average results of the two methods have been applied for both the Proctor and California densities.

Average for Proctor: $C = 1900$ lb. per sq. ft. $\phi = 10° 30'$.
Average for California: $C = 7660$ lb. per sq. ft. $\phi = 23° 45'$

Of special note is the tremendous increase in shearing strength which results when the California method of compaction is substituted for the Proctor method. The cohesion, i.e. shearing strength at zero normal unit stress, increases four-fold and the angle of internal friction doubles.

(d) Consolidation Tests

Consolidation tests have been performed on the impervious material to obtain the data from which to predict the total settlement in the earth fill. The soil was tested in the usual consolidometer devices following a standard procedure,[2] i.e. laterally confined samples were loaded and the total settlement recorded for each increment of load. To relate settlement and load, the results of these tests have been plotted on semi-log paper with void ratio as ordinate and consolidating pressure in tons per sq. ft. as abscissa. The void ratio is defined as the volume of voids per unit volume of soil particles in a soil mass. Void ratio, e, and settlement, $\triangle H$, are related as follows:

$$\triangle H = \left(\frac{e_1 - e_2}{1 + e_1}\right) H$$

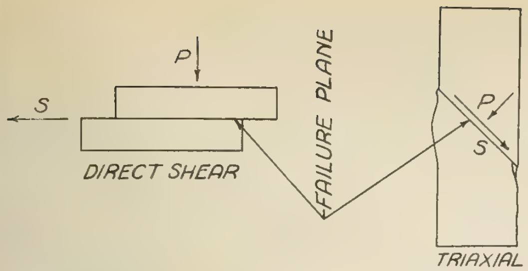
e_1 is the void ratio of a sample at a pressure P_1
e_2 is the void ratio of a sample at a pressure P_2
$\triangle H$ is the settlement which occurs when the void ratio decreases from e_1 to e_2 due to a pressure increase from P_1 to P_2 on a sample or layer of thickness H.

In Fig. 12 are shown typical pressure void ratio curves which resulted from consolidation tests on Proctor and California specimens. The sample for the Proctor compaction shown by curve No. 1 was placed in the consolidometer at a density of 134.3 lb. per cu. ft. and a void ratio of 0.42. It was saturated at a pressure of 0.025 ton per sq. ft. and some swelling occurred which resulted in a void ratio of nearly 0.44. The specimen was then loaded to a pressure of 9 tons per sq. ft. and, after sufficient time had elapsed for 95 to 100 per cent consolidation to occur at this maximum pressure, the load was removed by increments and the rebound curve determined. The same procedure was followed for the denser sample compacted by the California Method with the exception that it was saturated at a load of 0.5 ton per sq. ft. Neglecting the effect of swelling due to saturation, and basing the calculation on the original height of sample, curve No. 1 gives a settlement of 4.8 per cent while curve No. 2 shows only 0.9 per cent for a pressure of 9 tons per sq. ft. Here again the desirability of a higher density than that given by the Proctor method is emphasized because only a small fraction of the settlement would be experienced.

(e) Comparison with U.S. B. of R. Soils

In view of the fact that this department had little data on soil compaction for high dams and there is not a great deal in existing publications, it was thought wise to obtain information on materials which have been successfully used by the Bureau of Reclamation in high dams. The B. of R. has kindly supplied a summary of the soil characteristics and densities obtained in 14 major dams recently constructed. A study of this information indicates that the St. Mary glacial clay

Fig. 10—Soil specimens showing shear planes.



CURVE	TYPE OF TEST	AVERAGE DENSITY	AVERAGE WATER CONTENT
1	DIRECT SHEAR - QUICK	134.6#/cu.ft.	15.5%
2	TRIAXIAL SHEAR - QUICK	134.6	16.45%
3	DIRECT SHEAR - QUICK	143.7	10.7%
4	TRIAXIAL SHEAR - QUICK	142.6	11.6%

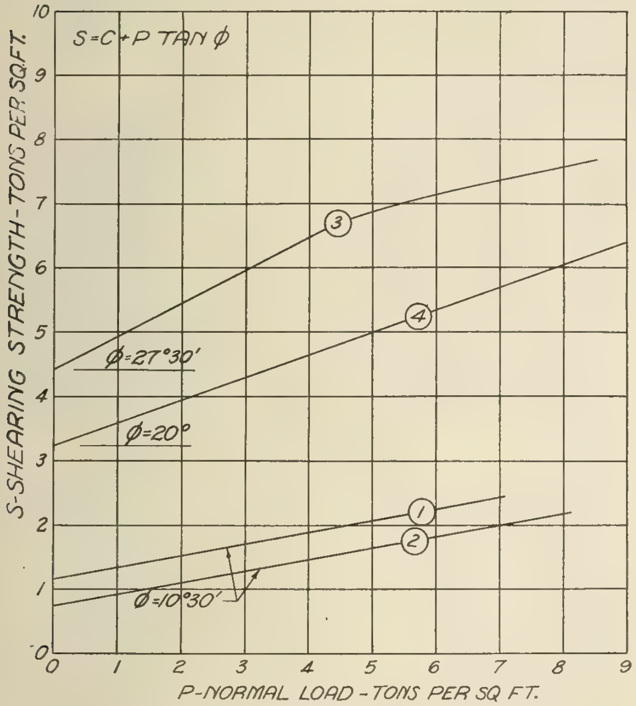


Fig. 11—Results of shear tests.

contains a much higher percentage of clay and silt than the impervious soils used in B. of R. dams. Unless a greater degree of compaction than the Proctor can be obtained, the St. Mary fill will be considerably less dense than the average of the U.S. dams, and much more compressible.

Analysis and Design

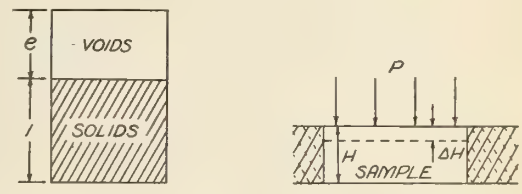
Prior to the soil mechanics study of this project, a rolled fill was favoured rather than an hydraulic fill or some type of concrete dam. An earth dam was considered more feasible than a concrete dam for the following reasons: A large quantity of glacial clay to build the former was available at the site, whereas, the aggregate for concrete would have to be hauled at least 8 miles, making this type of structure too expensive. Some settlement could be expected in the foundation which made a flexible dam desirable. A rolled fill was favoured rather than an hydraulic fill because of the following considerations: The layout of the site and the location of materials assured easy placement by rolled fill methods. Recent developments in earth moving equipment have given rolled fill construction a definite advantage over hydraulic fill methods for dams of the yardage and dimensions required for the St. Mary site.

The soil studies definitely indicated that a rolled fill dam was the better solution because the available material was too high in clay, as well as deficient in sand and gravel, to be satisfactory for an hydraulic fill dam. The soil in the borrow pit was slightly below the optimum required for compaction and no difficulty in adding moisture to reach the ideal water content for rolling was foreseen.

All the analyses applied to the design of the dam section have not been given.[10] The results of the stability study of the upstream slope, the settlement analysis and the seepage analysis are briefly covered. The stability studies of both side slopes showed that rapid drawdown on the upstream side was the most critical condition, therefore the downstream slope will not be considered.

Stability Analysis of the Upstream Slope[7]

This slope might be checked for stability under any of the following conditions: (1) during construction with the reservoir empty, (2) reservoir filled with water, (3) immediately after or during sudden drawdown of the water level in the reservoir. Condition (3), which is equivalent to a load suddenly applied at a time when the soil is saturated, was found to be the most critical. The added load on the slope due to sudden drawdown is caused by an increase from the submerged weight of the soil to the actual wet weight. Under these circumstances the soil may not have time to drain and develop internal friction, therefore its shearing resistance will consist entirely of cohesion.



VOID RATIO $e = \frac{\text{VOL. OF VOIDS}}{\text{VOL. OF SOLIDS}}$ $\Delta H = \left(\frac{e_1 - e_2}{1 + e_1}\right) H$

CURVE	INITIAL DENSITY	INITIAL WATER CONTENT	CALCULATED DENSITY AT CONSOLIDATION	CALCULATED WATER CONTENT AT CONSOLIDATION
1	134.3#/cu.ft.	14.56%	141.1#/cu.ft.	13.05%
2	144.3	11.32	145.2	10.69

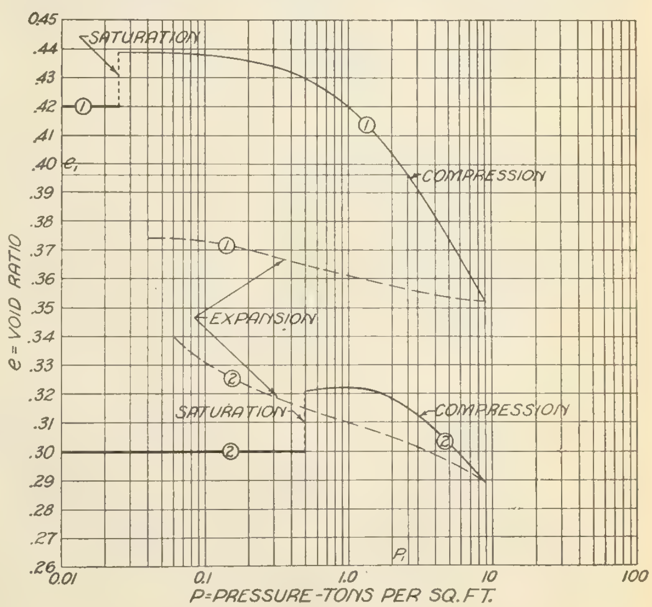


Fig. 12—Consolidation test results.

A number of different methods have been used to check the upstream slope for sudden drawdown but only one will be covered in this paper. It is known as the circular arc method and is the simplest and probably the most reliable for clay soils. This method is frequently used for the analysis of clay slopes where the load is applied rapidly and the angle of internal friction of the soil in the quick test is low. The basic assumption of this theory is that the soil will fail by sliding along a surface closely approximating a circular arc. It is also assumed that failure occurs simultaneously along the rupture surface and the resistance of the soil consists entirely of cohesion, that is, the angle of internal friction is zero. The forces acting on the sliding segment of soil are, the weight of the material which tends to cause the slide, and the shearing resistance of the soil acting on the circular arc which tends to hold the soil in place. In Fig. 13, the forces affecting the stability of the soil segment can be examined. The moment tending to cause a slide is equal to the total weight of the soil segment (W) multiplied by the horizontal distance (D) from its centre of gravity to the centre of rotation (O). The moment tending to resist a slide is equal to the product of the arc length (L), the cohesion of the soil (C), the radius of the arc (R). A factor of safety (F) is equal to the resisting moment divided by the overturning moment.

$$F = \frac{L \times C \times R}{W \times D}$$

In the case of the St. Mary clay, it was definitely felt that the possibility of excessive pore pressures occurring should be taken into account. With highly impervious materials which are slow to drain, pressures above hydrostatic are exerted on the soil particles by the pore water during the readjustment after sudden drawdown. These pressures tend to neutralize the normal unit stress (P) on the rupture surface and decrease the internal friction portion of the shearing resistance. Thus, for the St. Mary clay, this consideration further justified the use of the circular arc method in which the angle of internal friction is neglected.

The details of the slope analysis are shown in Fig. 13 and the factors of safety are tabulated for both the Proctor and California densities. Three failure arcs were analyzed, No. I and No. II for the entire height of slope, and No. III for the upper portion of the slope where the water level will fluctuate yearly. It is unlikely that the water level will ever be drawn down completely but it was thought prudent to investigate this condition with arcs No. I and No. II. To improve the factors of safety of the segments at Proctor densities, particularly along circles No. I and No. II, it was apparent that some type of counterweight near the toe of the slope would be beneficial. Therefore an analysis was carried out assuming a sandstone blanket on the lower portion of the slope. This material was considered to have a density of 125 lb. per cu. ft. and its shearing resistance was neglected. The factor of safety was increased on the three arcs by the sandstone layer; for No. I the increase was from 0.91 to 0.99. Therefore the slope would be unsafe if a density higher than the Proctor were not obtained, as common practice recommends a factor of safety of 1.5 for similar clay soils analyzed by this method. On each assumed failure arc the factor of safety was less than 1.5 for the Proctor density and greater than 3.0 for the California density.

Settlement Analysis[8]

Based on the results of the consolidation tests, calculations were made to determine the total compression which might take place within the earth fill if it were rolled to the Proctor density. In this analysis it has been assumed that the fill consisted of 9 soil layers whose total thickness was 185 ft., with the layers infinite in all directions. The settlement of each layer due to its own weight was small and its magnitude was rather uncertain, therefore it has been neglected. The settlement, $\triangle H$, in each layer due to the weight of the superimposed layers was determined by the formula

$$\triangle H = \left(\frac{e_1 - e_2}{1 + e_1}\right) H$$

which has been explained under Consolidation Tests. The stress was assumed constant throughout the thickness of any layer and was taken as the stress at the centre of that layer. Therefore in calculating the loads due to the superimposed layers, P_1 was taken as the stress at the centre of the layer due to its own weight and P_2 the pressure at the centre of the layer due to the superimposed layers. The void ratios, e_1 and e_2, corresponding to P_1 and P_2 were determined from curve No. 1, Fig. 12, under Consolidation Tests. The summation of the settlements in each layer gave a total compression of 6.2 ft. for the entire fill. The

F=FACTOR OF SAFETY = $\frac{R \times L \times C}{W \times D}$ W=w x AREA x 1FT.

C=COHESION

ASSUME FOR

PROCTOR w = 135 lb. per cu. ft. C = 1900 lb. per sq. ft.

CALIFORNIA w = 143 lb. per cu. ft. C = 7660 lb. per sq. ft.

F=FACTOR OF SAFETY				
CIRCLE	EARTH FILL WITH SANDSTONE SHOULDER		WITHOUT SANDSTONE SHOULDER	
	CALIFORNIA	PROCTOR	CALIFORNIA	PROCTOR
I	3.73	0.99	3.48	0.91
II	4.06	1.08	3.69	0.97
III	5.28	1.39	5.15	1.35

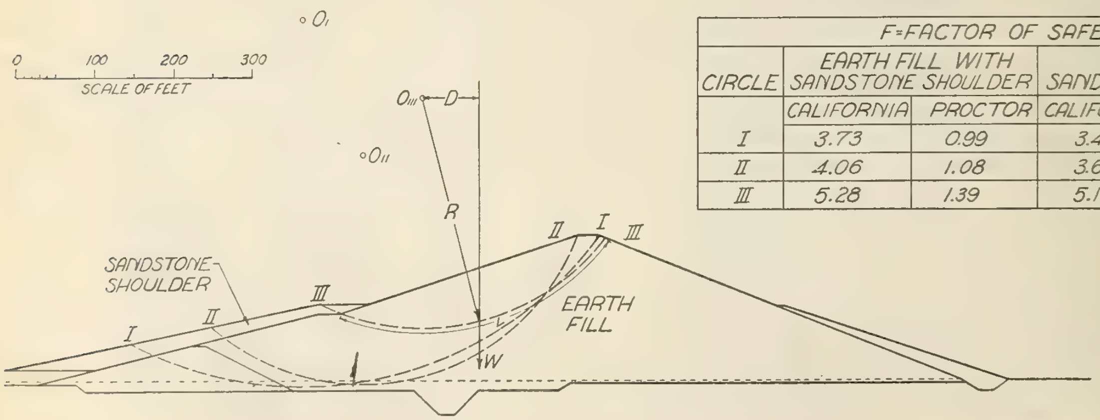


Fig. 13—Stability analysis of upstream slope.

settlement of the fill on the basis of the California density has not been calculated but, obviously, it would be a small fraction of that predicted above for the Proctor density.

The figure calculated is, of course, the total compression of the soil, and only a portion of this would ever become apparent at the crest of the dam because some settlement will take place during construction. Since the rate of consolidation depends entirely on the time for construction, the settlement at the crest is at present unpredictable. The total consolidation of 6.2 ft. is rather high but would not be objectionable in itself. The real danger would be the possibility of excessive pore water pressure building up due to the consolidation of this highly impervious material. Water pressure above hydrostatic in the body of the fill would cause a dangerous decrease in the shearing resistance of the soil.

Seepage Analysis

A seepage study using the flow net method was made on two proposed dam sections, one with an internal drain and one without. The purpose of this analysis was to determine the effect of the drain on the total quantity of seepage and on the position of the line of saturation. Flow net methods of studying seepage problems will not be discussed but interested readers are referred to the publication "Seepage Through Dams"[9]. In the seepage study illustrated in Fig. 14, it was assumed that the horizontal coefficient of permeability of the soil (K_h) was 4 times the vertical coefficient of permeability (K_v); that is, for a constant hydraulic gradient, the horizontal seepage velocity is 4 times the vertical. This assumption is not based on any tests for this particular material but rather on data which has shown that the horizontal coefficient of permeability of rolled fills varies from 2 to 10 times the vertical, depending on the method of construction.

In making a seepage analysis for the case in which K_h is greater than K_v, it is necessary to draw a flow net consisting of curvilinear squares on a transformed section, and then transfer the flow net back to the true section. The transformed section has the same vertical dimensions as the true section but the horizontal scale of the former is reduced by the factor $\sqrt{\frac{K_v}{K_h}}$.

The analysis indicated that it would be advisable to use a graded filter drain extending into the dam as shown. This would result in the line of seepage passing well within the downstream slope, whereas it would intersect the slope if an internal drain were not used. In dams where the seepage line intersects the downstream slope, soil erosion and sloughing frequently result. The theoretical quantity of seepage is doubled by this type of drain but that will not be serious because the estimated seepage through the dam is small in either case.

From the preceding analyses, and a comparison with B. of R. soil properties, it was obvious that a higher density than the Proctor would have to be attained in the glacial clay, otherwise the design of the dam section would have to be modified.

Discussions of Design Modifications

Three alternatives to modify the design presented themselves:

The first, to widen the sections of pervious material on either side of the clay core;

The second, to mix sand and gravel with the clay and build the entire section of a stabilized mixture;

The third, to increase the compacted density of the clay material to the range of California specifications.

Considering the first alternative, there was no doubt

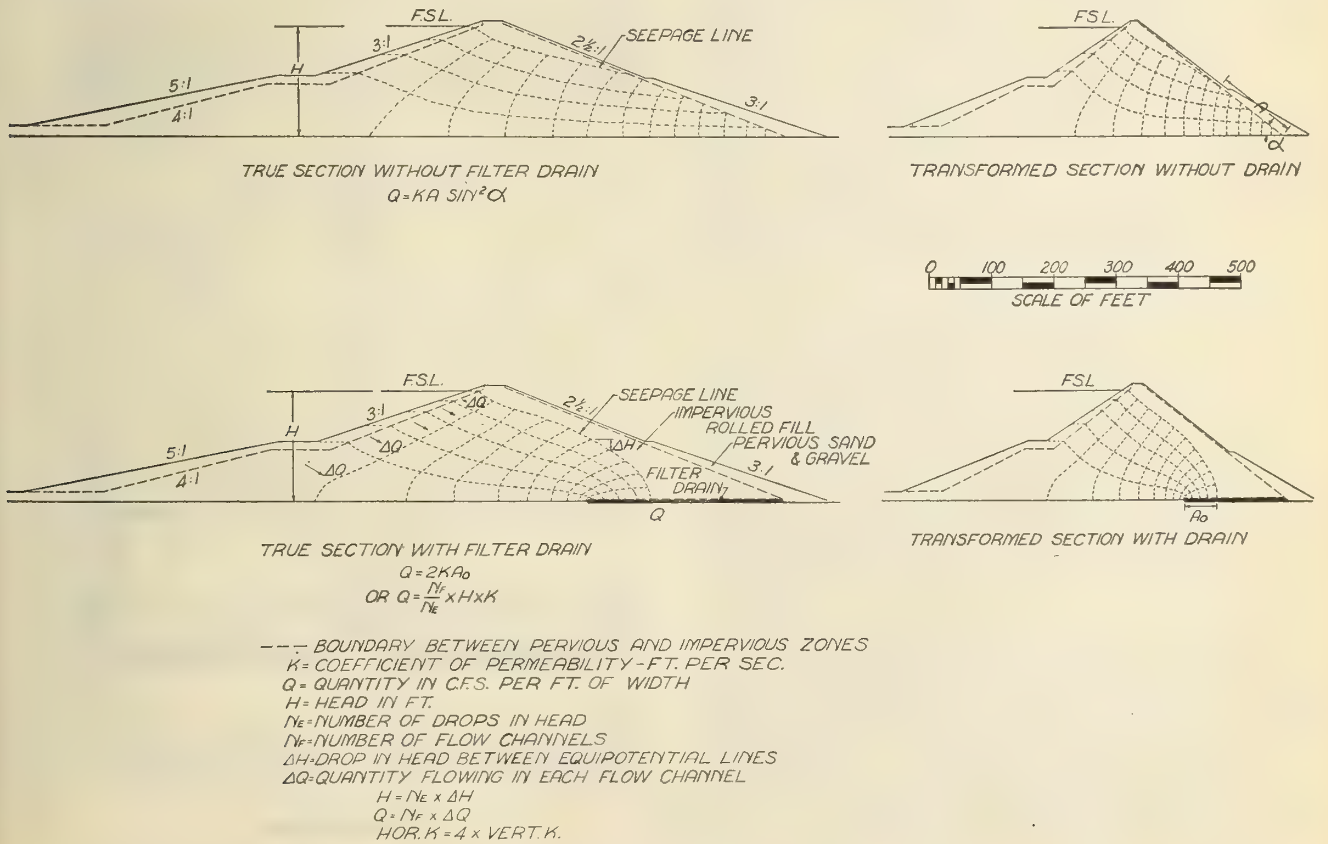


Fig. 14—Seepage analysis

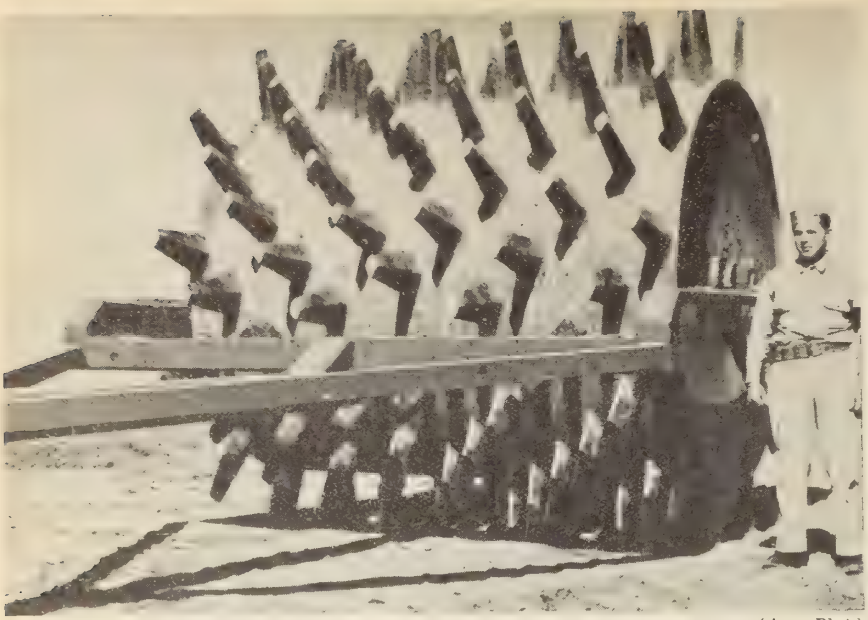


Fig. 15—Sheepsfoot roller used by Army engineers. *(Acme Photo)*

that a satisfactory structure could be built using a clay core with pervious sand and gravel shoulders. However, this modification which would greatly increase the cost, due to the long haul of the sand and gravel, has not been seriously considered other than from the economical standpoint.

The second alternative of mixing sand and gravel with the clay has been investigated. A mixture of 50 per cent pit run material passing the ¼ in. mesh and 50 per cent glacial clay was found to compact to a high density and its increased shearing strength would certainly ensure stability on the suggested slopes. However, consolidation tests indicated that the settlement would be reduced only slightly. If this alternative were adopted the cost would be greatly increased due to the additional work of mixing and the long haul of the coarse material.

The last alternative of increasing the compacted density to that of the California method was considered the best solution. The previous analyses have indicated that the side slopes of the present proposed design would be stable, and that there would be very little settlement. One question remains—Will it be economical and practical to get this increased density in the field using sheepsfoot rollers?

Discussion of Field Compaction with Sheepsfoot Rollers

Studies have revealed that it will likely be possible to attain the California density in the field by using a sheepsfoot with a pressure range of from 500 to 1000 lb. per sq. in. However, to be absolutely certain, a field test would have to be performed as little data is available on such a high degree of compaction for the type of soil under consideration. Until such time as a field test is carried out, it will be necessary to base decisions on laboratory tests and the following data from other sources.

Mr. O. J. Porter, who developed the California method, has stated that it is possible to obtain this density in the field by the use of sheepsfoot rollers. His method has been the basis of control for the work done by the California Department of Highways since 1929 and also has been adopted on a number of U.S. Army Airports. Mr. Porter has designed a sheepsfoot roller, illustrated in Fig. 15, which is capable of exerting unit pressures of 500 lb. per sq. in. empty and 1200 lb. per sq. in. when loaded with sand and water. The drum of this roller is 8 ft. in diameter and 10 ft. long, the feet of which are 18 in. in length. The total weight empty is 15 tons and when loaded is 37.5 tons. Densities equal to that of the California method have been obtained on various soil types using this machine. Mr. Porter feels that a roller exerting a pressure of 700 to 1000 lb. per sq. in. would give densities approaching that of the California for a soil such as the St. Mary clay.

The U.S. B. of R. has found that with 12 to 14 passes of a sheepsfoot roller exerting a unit pressure of 488 lb. per sq. in., field densities comparable to that of the Proctor method with the 18 in. drop, can be obtained. The Bureau, apparently, has not used rollers heavier than about 500 lb. per sq. in.

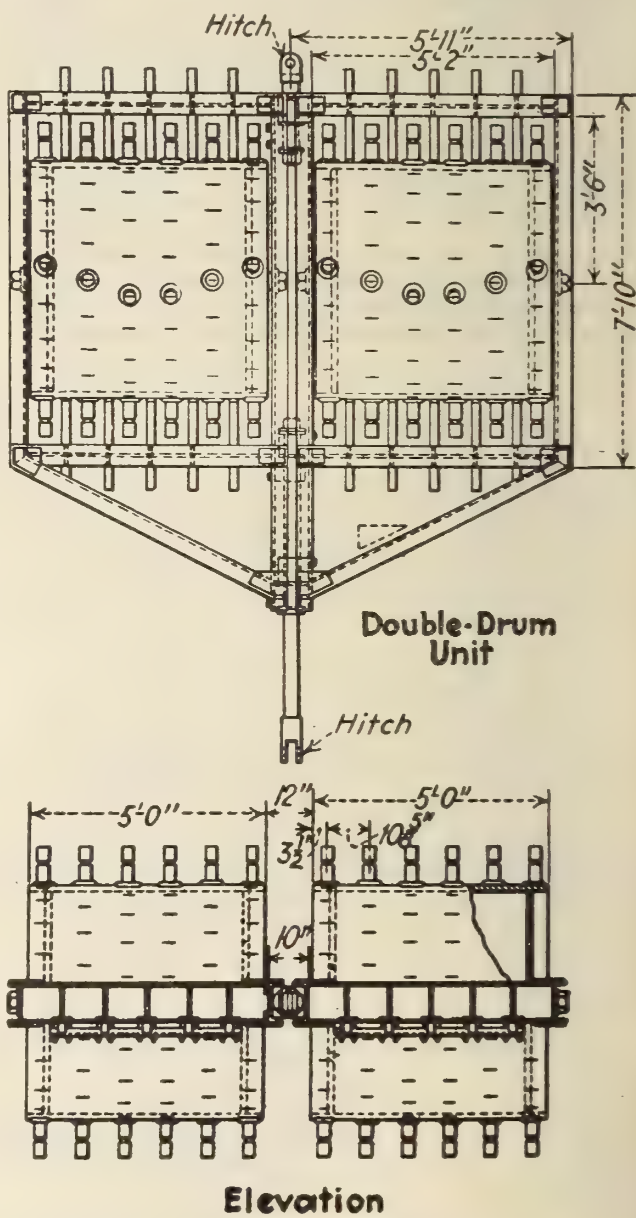


Fig. 16—U.S. B. of R. standard sheepsfoot roller.

because a sufficient density was attained with this degree of compaction for their soils. Plan and elevation views of the above mentioned roller are shown in Fig. 16.

The present trend is definitely toward sheepsfoot rollers exerting higher unit pressures, particularly where stabilization of poor clay soils is required. The following are a few examples on recent dams:

On the Merriman cofferdam, which was constructed for the Board of Water Supply of New York, rollers exerting a unit pressure of from 438 to 642 lb. per sq. in. were used. (*Engineering News Record*, Vol. 127, Page 913, December 1941).

At the Denison dam in Texas, an earth fill 190 ft. in height, 7 passes of a sheepsfoot exerting a unit pressure of 550 lb. per sq. in. were required. (*Civil Engineering*, Vol. 11, Page 478, August 1941).

On the Wappapello dam, sheepsfoot rollers giving a unit pressure of 267 to 583 lb. per sq. in. were used. (*Civil Engineering*, Vol. 10, Page 588, September 1940).

At the Shand dam in Ontario, a field compaction test was made which resulted in the foot pressure of the sheepsfoot roller being increased from 223 to 255 lb. per sq. in. (*Engineering Journal*, Volume 23, Page 170, February 1940).

On the Duncairn dam, a rolled fill 70 ft. in height which was constructed by the P.F.R.A., rollers exerting a maximum pressure of 200 lb. per sq. in. gave satisfactory densities.

Having assumed that it will be economical and practical to increase the degree of compaction, are there any objections to such a high density for this predominantly clay soil? Yes. There is a definite danger of swelling near the faces of the slopes and at the top of the dam. This can be overcome by reducing the compaction and hence the density as these points are approached, and by blanketing the slopes with a sufficient weight of gravel to prevent swelling under any water conditions. A very practical problem exists in the possibility of swelling and expansion taking place in the top layer of the completed fill between construction seasons.

Conclusion

The soil mechanics investigation resulted in the adoption of the original design with some modifications. This design is by far the most economical, making use largely of material close at hand. The outstanding point brought to light by the laboratory studies was the necessity of soil compaction, by heavy sheepsfoot rollers, at a relatively low water content to obtain a stable fill.

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DISCUSSION

G. L. MacKenzie, m.e.i.c.[1]

Before proceeding with any discussion of the paper I wish to emphasize that the project is still in the design stage, and subsequent tests and investigations might modify the design.

Mr. Peterson has indicated that the fill material available at the site is very impervious. His laboratory tests disclose that, in order to secure a stable fill with this material, it will have to be consolidated to a density of about 143 lb. per cu. ft. with a resulting factor of safety of approximately 3.73. This at first appears to be a high factor of safety, but an examination of the compaction curves in Fig. 8 shows that to attain this degree of compaction the water content must be maintained between the limits 9.7 and 11.3 per cent. This is a very narrow limit and, as this tolerance increases, the factor of safety will decrease.

The principal factors in the construction will be:

(1) The control of the moisture content within the necessary narrow limits, and

(2) The securing of this very high degree of compaction.

In connection with the moisture content, it has been recognized that the ideal method of applying water for construction of earth fills is by irrigation of the borrow pits. In this case however, the material is quite impervious and I would be concerned about the possibility of securing the proper water content in this manner because I would suspect that both penetration and drainage would be slow and doubtful. It should be noted too that the analysis of the borrow material discloses an existing water content varying from 6 to 15 per cent. This being the case, some of the material is now above the desired optimum water content and it will have to be reduced. This will have to be done by mixing the fill with drier material, which might be an expensive operation and difficult to control.

In connection with the compaction, it would certainly appear necessary to perform an actual field test. It would have to be determined that a roller similar to that described by Mr. Peterson would provide the required compaction and in fact it would have to be demonstrated that it would not bog down on the fill. At the same time the cost of its operation could be determined.

I am willing to accept Mr. Peterson's laboratory conclusions as to the required density and that they are in accordance with the latest theories of soil mechanics. I am confident that, provided the moisture content limitations are not too restricted to be controlled in the field, and provided that the roller described can actually be operated in such plastic material, the design recommended by Mr. Peterson will be stable and the most economical of all the suggested alternatives.

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W. L. Foss, M.E.I.C.[2]

With regard to the St. Mary dam, I think the important point brought out by the soils investigation is the possibility of treating the inexpensive fill material in such a manner that it can be used for practically the whole section. If compaction were limited to previously accepted methods, it appears that a substantial portion of the fill would have to consist of relatively expensive and scarce pervious materials. It is estimated that approximately $400,000 can be saved by the suggested design, with earth fill at 25c per cu. yd. and pervious fill at 75c. Even if sufficient quantities of pervious fill were available, which is doubtful, it would have to be hauled about eight miles.

It may be asked whether a concrete dam may compare favourably with the proposed design. I may say that it is estimated that a concrete gravity structure would cost about $750,000 more, with mass concrete at seven dollars per yard. In addition to cost, there are other factors which are not favourable to a rigid structure. The existence of lenses of comparatively soft shaly materials in the foundation rock may make for uneven settlement.

Since the above comparison in cost is based on the assumption that the presently proposed spillway can be eliminated, provision would have to be made to handle flood flows over the dam. This will entail the use of crest gates about five feet in height, since the reservoir cannot be allowed to rise more than three feet, due to the fact that the canal from the Belly river comes in at this elevation. A stilling basin at the toe of the dam to protect the river banks and bed may be quite expensive.

The young science of soil mechanics has relieved many a headache for the general engineer. Not many years ago, our so-called designs involving earth and earth foundations could be little more than guesses. Generally, we can now predict the behaviour of earth in many ways which were formerly not possible. It appears, however, that much remains to be done, and I am thinking at the moment of lateral or horizontal earth pressures.

Some structural problems involving lateral earth pressures are, of course, retaining walls and pipes or conduits buried in earth fills, as well as tunnel linings.

In a semi-infinite mass of soil, the pressure in a vertical direction at depth D is WD where W is the unit weight. From theory, the active and passive horizontal pressures at any depth D can be expressed in terms of the cohesion, C, and angle of internal friction ϕ, of the soil. They are:

$$\sigma_a = \frac{-2C}{tan\ (45° + \frac{\phi}{2})} + \frac{WD}{tan^2\ (45° + \frac{\phi}{2})} \qquad (1)$$

$$\sigma_p = 2C\ tan\ (45° + \frac{\phi}{2}) + WD\ tan2\ (45° + \frac{\phi}{2}) \qquad (2)^*$$

where σ_a is unit active pressure and σ_p is unit passive pressure.

It is seen that the results of shear tests will permit an estimate of active and passive pressures. Both these values are developed on the assumption that shear failures are taking place within the soil mass, and are therefore states of stress during some movement or flow of the soil. More often we are interested in the horizontal pressures existing when the soil is at rest, or in any case when movements are very small. Here is where the problem becomes difficult.

During the investigation of the feasibility of building a conduit under the dam for river diversion during construction, this matter of soil pressures was seen to be very important. While it was proposed to encase the lower half of the circular concrete pipe in rock, the upper half would be subjected to earth pressures. Owing to the delicate balance of moments, the magnitude of the horizontal pressure was extremely important.

Attempts were made in our laboratory to determine the horizontal pressures at rest, since deflections in the comparatively rigid pipe were small. The first test was made with the triaxial shear machine, wherein vertical and horizontal loads were applied in such a manner that no lateral deformation would take place in the sample. Vertical stresses were plotted against the ratio K_O of horizontal to vertical stress, and it was found that this ratio increased from 0.5 at a vertical stress of 20 lb. in^2 to 0.78 at 100 lb. in^2, after which the value appeared to remain constant.

Other apparatuses were designed to attempt to check these values, but results were poor. One of the devices consisted of a thin walled cylinder about 3¼ inches in diameter and 1 inch high, open at both ends. This was packed with soil, a load applied on a disc at the top, and the expansion of the cylinder measured by means of metalectric strain gauges cemented to the outside. Peculiar results were obtained. It appeared that the value of K_O decreased, rather than increased, with vertical stress. In fact values of K_O greater than 1 were obtained at low vertical loads.

I am inclined to accept the triaxial results, but there is no doubt that there is a need for the development of technique in determining values for a given soil under given conditions. Suppose that active, passive and horizontal pressures at rest are determined with reasonable accuracy. There still remains the problem of small movements of a structure against or away from, the soil. In other words, how far will the wall of a conduit, for instance, have to move to set up the ultimate passive pressure as given by equation (2) ? In the case of fills, no doubt the degree of compaction immediately adjacent to the wall will have some effect. But even assuming uniform density throughout the mass, is it still possible to determine the relation between the magnitude of the movement of the wall against the soil, and the passive pressure set up ?

W. F. Riddell, M.E.I.C.[3]

Compacted earth dams subject to a more or less constant head of water, so that soil conditions are reasonably constant, provide the most favourable condition for this type of structure, and will doubtless in future be more commonly used. Dams which are constructed for flood control purposes, and are subject to large summer draw downs, provide fairly long periods of time when the structure is subject to drying and freezing action from both sides. In the larger structures, such as the St. Mary dam, this action would not penetrate deep enough to be of any serious consequence, but, in smaller structures, this detrimental action might require special consideration lest rapid flooding in the spring season find a fatal weakness in some part of the structure, due to unexpected changes in soil conditions caused by drying and freezing, followed by rapid restoration of the water head.

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*Theoretical Soil Mechanics, Terzaghi.

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G. N. Houston, M.E.I.C.[4]

The author states that, as a result of these laboratory investigations, they adopted the original design with some modifications, the inference being that a different design had been worked out previous to this analysis. It would be interesting to have the details of this design which was abandoned when they returned to what the author calls the original.

Inasmuch as it is practically impossible to reproduce and maintain laboratory conditions in the field when constructing an earth fill of this size, due to cloud bursts, normal precipitation, hot winds, variation in the moisture content and other characteristics of the material in place, etc., the question arises: to what extent should we allow the results of this laboratory analysis to govern our design?

Earth is not like steel, cement or concrete, or a manufactured article the uniform quality of which can be carefully controlled during manufacture.

When safety of life and property is involved, how much risk if any are we warranted in taking in order to reduce first cost?

The writer is suggesting these questions because they should be given very careful consideration before the design is finally approved.

R. M. Hardy, M.E.I.C.[5]

This discussion will be confined to one or two points concerning the laboratory shear tests and the question of the high proposed densities.

I am somewhat puzzled by the comparatively large variation in the angles of internal friction between tests reported in Fig. 11. Moreover, it is difficult to reconcile the high values of ϕ for curves 3 and 4 with the statement that they are from "quick tests". Consolidation tests on this type of material usually require a time of the order of hours for the pore pressure due to a load increment on the sample to be dissipated. The disappearance of pore pressure within the shear test samples would require about the same time in the direct shear test and a longer interval in the triaxial test. Since internal friction can develop only as initial pore pressure decreases it is hard to understand the high values on internal friction cited as from "quick" tests.

The difficulty seems to arise from Mr. Peterson's definition of a quick test as one in which the load is "applied at such a rate that failure of the sample will take place in about ten minutes." It is submitted that a quick test should rather be defined as one in which the load is applied at such a rate that the pore pressure does not materially decrease during the test.

In our experience a definition based on an exact time limitation has no real meaning except as applied to a particular soil and a definite size of sample. For example, in the Soil Mechanics laboratory at the University of Alberta we have secured values of angle of internal friction from zero up to 30 deg. from triaxial tests run in about 20 minutes. These tests were on samples from the same alluvial deposit but having different percentages of clay particles. The one extreme is a "quick" test, the other a "slow" test.

Mr. Peterson's shear tests were run on compacted samples which, according to his Fig. 8, were not fully saturated. In this case it would be expected that the air in the voids would be compressed by a load increment, thus preventing the development of pore pressures as great as if the sample were fully saturated. It would, therefore, be of interest to know the approximate percentage deformations at failure for the Proctor compacted samples as compared to the California compacted samples.

It is suggested that the pore pressure conditions in the samples from the two types of compaction may be quite different due to the variation in deformation characteristics of the two materials.

We would hesitate to compare the angles of internal friction for the two types of compacted samples before being reasonably sure that the pore pressure conditions during the tests are identical.

On the matter of the high densities proposed for the dam, of considerable importance, if they are used, would be the swelling pressures developed as the dam becomes saturated. These would not be objectionable provided the weight of the overburden at any point is sufficient to prevent swelling deformation. This leads to a consideration of the magnitude of the pressure that may be developed by a swelling soil.

We are, at present, running a series of tests in our Soil Mechanics laboratory attempting to measure the swelling pressures developed in local glacial clays as water is added to the soil at different moisture contents. These indicate that pressures of the order of 1 to 1½ tons per sq. ft. may be developed when water is added with the soil at a moisture content of less than about 12 per cent. With this type of soil compacted to the California density, the swelling pressures, however, would probably be at least double these figures.

Mr. Peterson recognizes that the high densities from the California compaction method cannot be used near the surface but it is submitted that some consideration should be given as to the minimum depth at which they can be safely used.

I am in general agreement with Mr. Peterson's theoretical analysis. It should be realized, however, that while such analyses have been used successfully as a basis for construction on other dams, experience is being extrapolated somewhat in designing a structure of the proposed dimensions using this type of soil and such high densities. A considerable amount of field work will therefore be justified on test strips to determine the efficacy of the design before construction of the dam is started. Such field tests under the circumstances would in no way discredit the excellent design procedure followed.

I. F. Morrison, M.E.I.C.[6]

In this excellent and very interesting paper, there are one or two points upon which the writer would like to comment.

In Coulomb's equation, the author does not make clear that, when it is applied to a two-phase, water-soil, system, the normal unit stress P is the unit pressure acting on the soil skeleton and not the total pressure normal to a plane element at the point considered. The total normal pressure is the sum of the pressures on the water-phase P_w and on the soil skeleton P_s. Under constant load, it is constant, whereas the two pressures, of which it is the sum, are not. They vary with time and the coefficient of consolidation in accordance with the theory of consolidation.

To make this clear, Coulomb's equation should be written:

$$S = C + P\left(\frac{P - P_w}{P}\right) \tan\phi$$

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Obviously, in a shear (triaxial) test if the pressure $P = P_w$, then the second term in Coulomb's equation becomes null. This gives the impression that tan ϕ becomes zero and that, therefore, $\phi = 0$. But this is not so.

If one writes, however,

$$\frac{P - P_w}{P} \tan \phi = \tan \phi'$$

Then ϕ' does become zero.

This is what happens in what is called a "quick-test".

A detailed mathematical treatment of the mechanical behaviour at sudden draw-down shows that the term which represents the friction $P_s \tan \phi$ in Coulomb's equation applied to the soil at the sliding surface prior to draw-down is retained in the equation for S after draw-down of amount h_1 feet, and that a third term $wh_1 \tan \phi'$ is added. It is this third term which may be null depending on the time and the coefficient of consolidation.

For this reason the writer does not believe a proper analysis can be made by neglecting the fraction already present, if any, prior to draw-down as the author has done.

Krey shows that the centre of the critical sliding circle is dependent on both C and ϕ, which would be different from the centre of the critical circle if C alone be considered. Besides, the friction circle should be used in the analysis. The danger due to sudden draw-down arises from the suddenly increased weight of the sliding mass and the seepage pressure. Partial draw-down increases the load in the upper part of the sliding mass without a corresponding increase in the lower part. For example, a draw-down only as far as the berm directly below point 0_{II} would be more dangerous than a complete draw-down for the sliding circle II (Fig. 13).

The seepage pressure has been omitted in the above discussion for the purpose of simplification but that does not mean that it is unimportant.

The Author

The response, both in the form of general interest and discussion, to the papers on soil mechanics presented before the annual meeting has been most gratifying.

The helpful criticisms and suggestions have already prompted the performance of further tests on the St. Mary glacial clay.

The point raised by Mr. Riddell in connection with frost heaving and drying out of the fill material in flood control dams is most important. The P.F.R.A. has experienced considerable difficulty due to shrinkage caused by drying in the clay fill materials of stock watering dams. On the larger type dam, pervious material or a stabilized mixture may be used in the dangerous zones, whereas in the case of the smaller dam where only clay soils are easily available, the use of sand and gravel would result in a greater percentage increase in the cost. Therefore it may be good engineering practice to construct the cheaper dam, even with a chance of failure due to these causes where the possibility of loss of life is nil and property damage is small, rather than to declare the project non-feasible due to high initial cost.

Referring to the design sections as questioned by Mr. Houston, the original section consisted almost entirely of compacted glacial clay except for rock riprap on the upstream slope and the rock section on the downstream slope. Modifications as a result of soil mechanics studies included the following: (1) A pervious sand and gravel section replacing the glacial clay on the upstream slope in the zone of sudden drawdown. (2) The addition of a sandstone blanket on the upstream slope below low water level. (3) A sand and gravel blanket covering the entire downstream slope of the compacted clay fill. (4) The addition of a graded filter beneath the downstream portion of the fill. In addition to the above modifications, the laboratory studies indicated that special care in placing and compacting the clay fill would be required.

Like Mr. Houston, many engineers wonder what expense is justified in the field to attain the ideal placing conditions as determined in the laboratory. From the experience of the U.S.B. of R. on numerous projects constructed over a large area of the United States, it has been found that the conditions specified by laboratory investigation could be very nearly obtained. However there are a great number of variables, and each project is a problem in itself. In the case of a large earth fill in the United States a huge tent was used over the fill area to prevent soaking from rain during construction. On small P.F.R.A. dams it has been found that clay soils can be placed at water contents close to the optimum by irrigating the borrow pit and then by sprinkling on the fill during placing and rolling.

Like Professor Hardy, the author was inclined to question the high angle of internal friction which the shear tests indicated for the Califonria density. However as pointed out by Professor Hardy, these shear tests are not true "quick tests" because full pore pressure was never developed. A true "quick test" on a cohesive material should give a very low apparent angle of internal friction. In the analysis for sudden drawdown, the value of the cohesion only was used and it was assumed that due to pore pressure the internal friction was zero. The value of cohesion as used in the design analysis has been found to be identical with that obtained from true "quick tests".

In connection with swelling pressures exerted by soil at the California density, it appears that the intensity of pressure varies greatly with small changes in the water content at which the soil was compacted. A test on a sample slightly above the optimum water content indicated a pressure of less than one tone per square foot, whereas a sample slightly below the optimum exerted over three tons per square foot.

The author would like to thank Professor Morrison for his clarifying remarks on the relationship between the stress in the soil water and the stress on the soil skeleton in a two phase system. Professor Morrison shows that the angle of internal friction ϕ does not become zero but that the apparent angle of internal friction ϕ' is zero for this case.

Possibly some internal friction should have been considered for a proper stability analysis, but in view of the fact that there is little published data on the application of the results of shear tests to dam design and further that the number and type of shear tests performed were limited, it was thought wise to use this simple and conservative method for sudden drawdown which takes no account of the internal friction portion of the shearing strength. Engineers of the U.S.B. of R. are of a similar opinion to that of Professor Morrison, that the method used is conservative and suggest that the actual pore pressure be measured to determine the effective normal pressure on the soil skeleton.

In conclusion, the author would like to thank the discussors for their valuable contributions and also the two chairmen, Professor R. F. Legget and Professor A. E. Macdonald, for their part in making the soil mechanics session a success.

APPLICATION OF SOIL MECHANICS TO THE DESIGN AND MAINTENANCE OF PRAIRIE HIGHWAYS

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Soil mechanics may be defined as that branch of science which deals with the performance of soil as a structural material. Under this heading much progress has been made in the study of stress distribution in soils; in measuring pressures to be provided for in the design of foundations, retaining walls, bridge abutments and massive earth structures. In the last ten years, the development of equipment to make the precise pressure and strength measurements has progressed rapidly. With these developments, original theories can be tested and practical applications made to the design and construction of foundations and earth structures. In the early 1920's, however, many of the theories regarding stresses in soils were controversial, and to follow the theory through to a practical application involved higher mathematics and assumptions out of the realm of most practising engineers.

In the field of highway engineering, the rapid growth of highway transportation forced highway organizations to begin soils investigations on a practical basis for immediate general use in their particular field. The beginning consisted of a series of co-operative surveys of existing roads under the following main headings:

1. Type and volume of traffic
2. Climatic conditions
3. Character and condition of subgrade
4. Type and condition of surface

The purpose of the surveys was to develop tests and standards whereby improved and more dependable road service could be obtained from the abundant and inexpensive road building materials. The immediate difficulty encountered in the surveys was a method of measurement and comparison for reporting data on subgrades. In one of the early co-operative studies; namely, "A Study of the Sand-Clay Topsoil Roads of Georgia," undertaken by Dr. Strahan in 1922, identification of the soils was by sieve analysis only. Similarly in 1920, on a survey of 1200 miles of roads in California, the subgrades were identified only by texture such as clay, loam, etc. on the U.S. Bureau of Agriculture grouping. The gradation was not a sufficient description of soils for comparison and further tests were needed which would indicate the important characteristics such as shrinkage, capillarity, plasticity, and drainage qualities.

The result of the combined efforts of many investigators was summed up and presented in a report by the Bureau of Public Roads in 1929 which recommended a standardized procedure for testing soils, and from the test values classified the soils into groups of similar performance.

The tests used to classify the soils are:

Mechanical Analysis—Grain size

Physical Analysis

Liquid limit	
Plastic limit	Plasticity
Plasticity index	
Shrinkage limit	
Shrinkage ratio	Volume change
Lineal shrinkage	

Field moisture equivalent—Moisture capacity

Centrifuge moisture equivalent—Resistance to flow of water.

The fundamental principle of these physical tests is that as the moisture evaporates from a slurry of soil and water, the mass passes successively from a liquid, to a plastic, to a solid state. The arbitrarily chosen tests determine the moisture contents which approximate the limits of these stages. From experience it has been found that these limits vary with different soils. This fact serves to identify the soils for, if the limits of each stage as determined by the tests on two soils are the same, the physical characteristics of the soils are the same and they can be expected to react similarly when used in highway construction. The difficulty with these simplified soil tests is that the relation between the test and the actual structural strength of the soil is very complex, and they serve only to indicate the presence or absence of physical characteristics. Much work has been done on the measurement of actual strength of soils in pounds per square inch, the familiar yardstick for less abundant materials such as steel and concrete, but for soils the strength is not a fixed quantity and is governed by fluctuations in moisture content, density, and conditions of loading. Because of the many variables, the tests of structural strength are somewhat involved and the interpretation of the test results must be made with judgement as to how closely the conditions of the test compare to actual conditions in the particular design.

Because of the involved nature of the structural tests and the difficulties in using the values in general design, the approach of highway engineers to soil mechanics has been in identifying the soils and conditions as they exist in roads in service and applying the experience gained from past construction to new design. With the materials identified, the application of past experience may be made in a sound practical manner and the designer may use not only the experience in his own particular area but the knowledge gained in other areas, selecting intelligently the features which will apply to his own particular conditions.

In the above, the development and use of the soil tests for identification has been stressed; the description of the tests has been omitted as they are now A.S.T.M. standards and while simple in operation must be performed precisely as described for accurate results. Some highway departments have developed their own system of classification of soils with the view of simplifying the reporting of the many tests. Of these simplified classifications those in use in North Dakota, Wyoming and Kansas are well worth considering from the point of simplicity in use. The Public Roads Administration revised its original classification in 1943 to reduce the amount of testing necessary for identification. The principles in these newer classifications are the same as in the original, but the trend is to simplification of testing and reporting in order to facilitate the use of the tests by the engineer on construction.

As in the case of the soil tests, the descriptions of these soil classifications, the limits of each soil group and basic construction recommendations for each group are published elsewhere and will not be repeated here.

Soil Surveys

In the design of a foundation for a building, a bridge or a dam, the area involved is relatively small. Elaborate subsoil investigations may be carried out to obtain an accurate picture of conditions. Very complete sampling is possible and extensive testing, duplicating the conditions existing on the small area, may be made. In highway work, the area concerned is narrow in width but in comparison is almost infinite in length. It stretches for miles through a variety of geological and topographical conditions. In order that the information can be obtained, the investigations must be simple both in field work and the laboratory.

The usual practice, and that which is used in the Manitoba Highways Branch, is to make auger borings 4 to 6 ft. in depth on normal fill sections, 4 ft. below grade on cut sections, and to the depth permissible by drainage features in borrow areas. The spacing of the borings depends on topography and soil conditions. In flat uniform country, the maximum spacing is 500 ft. and advantage is taken of existing cuts to observe the layer of soil in place; in rolling country, tops of hills, bottom of sags and points of change from cut to fill are examined. An experienced man soon learns to space his borings from observations of topography and vegetation changes. Samples of the type of soils encountered are taken to the laboratory for testing and classification. On the borings, the occurrence of each soil type and the depth of the layer are recorded. Frequent samples are taken to determine moisture content, and the density of the soils in place is determined. When the samples are identified, the soil profile is plotted from the record of the borings. Any special design features such as subcuts to remove frost heaving material, selection of areas of good material for borrow, shrinkage to be expected in construction, are noted and recommendations for the general design of surface and cross-section made. In some cases where the conditions are uniform, the profile is only plotted for sections requiring special treatment and a report is made on the whole project.

The main variant to this type of soil survey is that used in Michigan, Missouri and Indiana where the pedological soil survey is used. Where a province has been mapped for agricultural purposes, the areas shown as of the same soil type will have the same soil profile throughout. The depth of the various layers may change but the same sequence of soil layers exists in the profile. As the soil type is dependent upon the geological origin of the soil, climate and topography it is obvious that, in order that the same soils be developed in any two areas, they must have essentially the same geology, climate, and topography, and therefore engineering features of design adopted for the one area should hold for the second. This is the basis on which the pedological system is used by highway departments. In Michigan, a chart has been drawn up listing the basic recommendations for highway construction for each soil type occurring in the state. Thus, where the pedological soil types have been identified, the soil survey is merely a matter of locating boundaries and checking special conditions. It must be kept in mind that the Michigan State Highway Department has had a soils organization in operation since 1926, and had to accumulate fund of data to determine the basic recommendations and make this method of classification possible. There is no doubt that a great deal of pertinent information can be obtained from the agricultural soil maps, where they are available, and by relating the engineering data compiled to these soil types, soil surveys can be much simplified.

Measurements of Structural Strength of Soils

The measurement of the structural strength of soils has been mentioned, but in highway work the practice has not, at the present, been generally adopted. A census taken by the Highway Research Board in 1939 showed 44 states using the indicator soil tests and surveys, as described above, but only half of these using structural strength tests. This is not due to lack of importance of the structural tests but due to a lack of standardization in the testing procedure and the interpretation of the values in design.

The structural strength measurements in most common use are the shear tests and settlement tests. These have been used to good advantage in foundation design. In highway engineering, the use of these tests to date has been limited to the design of bridge abutments and high fills. The stability of a fill is a function of the height, width of base, and shear strength of soil both in the fill and below the fill. For average highway embankments the width required for traffic lanes, shoulders, and satisfactory slopes for safety, overbalances the possibility of shear failures. There are always however the exceptional cases where shear strength of the soil and possible settlement of the foundation are the governing factors. In the 1944 construction season, on one project the grade line selected required an 18 ft. cut on a knoll running into a 22 ft. fill through a swamp. The standard cross section of embankment on the highway was a 40 ft. width of grade and 4:1 slopes. With heights over 5 ft., however, the practice has been to steepen the slopes and use guard rail. For a given height, the degree to which it is safe to steepen the slopes is governed by the shear strength of the soils. In deciding on the slopes for this particular project, a study was made of some of the slope design formulae which have been published. In order to use these designs, the value of shear strength for the particular soil, a fine cohesionless blow sand, had to be assumed. The assumed values were interpolated from determinations made on similar materials by other departments but actually the whole design was based on an assumption of shear strength for the par-

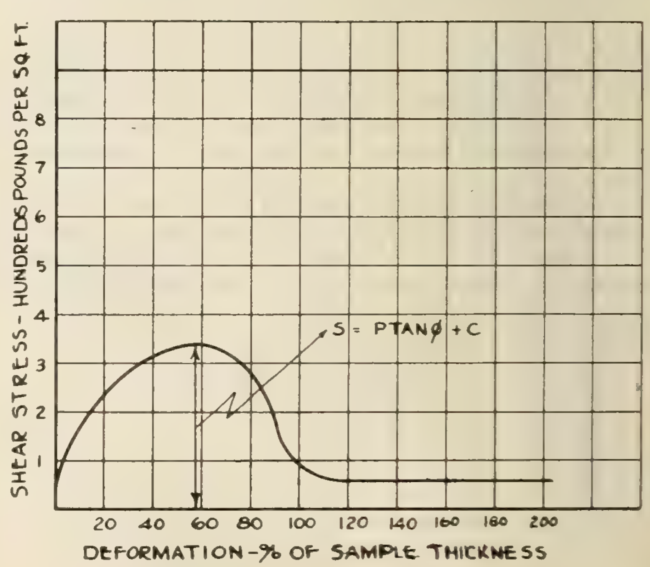

Fig. 1—Stress-strain relation in shear tests.

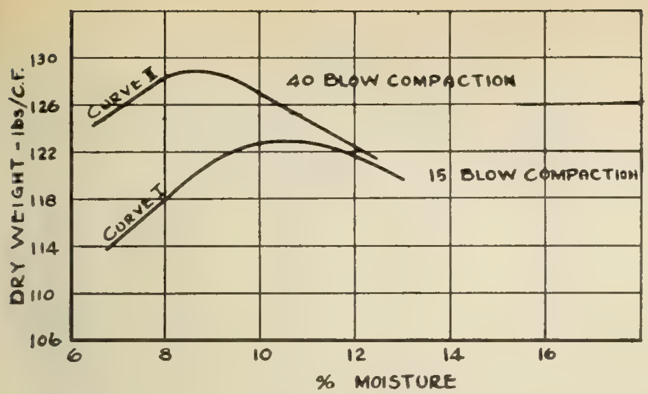

Fig. 2—Typical compaction curves.

ticular soil. The department has now built a direct shear machine in order that similar design may be made more rationally in the future.

A number of points occur in the use of shear tests however, which make their application in design difficult. There are the mechanical limitations of the testing machine in duplicating field conditions. The influence of these limitations can only be determined by utilization of the tests and careful study of data obtained. The basic theory in the shear tests is by Coulomb and may be shown as follows:

$$S = P \tan \phi + C$$

S = shear strength
P = normal load
ϕ = angle of internal friction
C = resistance due to cohesion

In the tests to determine shear strength, the soil sample is loaded with a normal load, and a shearing load is applied. From studies of reports by different investigators and some personal observations, it appears that the ultimate shear strength value obtained is largely dependent upon the rate of applying the shearing load. If large increments of load are applied, the value may be quite different from the result obtained where small increments are used. There is also difficulty in determining what constitutes a shear failure. As shown in Fig. 1, up to the ultimate value the stress increases with deformation. To use the ultimate shear value in design would not seem sound, as in some cases the deformation at this point would constitute failure. A further point of query on shear tests is in the expressing of the shear strength in relation to the area of sample tested. By the time the ultimate value is reached the deformation has reduced the area of sample resisting shear. Should the shearing load be expressed on the reduced area or on the original sample area?

These points of question do not lessen the value of the test, they merely emphasize the necessity for more investigation. The logical development of the structural tests would be parallel to the indicator tests previously described, that is, standardization of procedure, utilization of the tests in design and construction, and compilation of data on the service records of the completed projects. A sound start could be made in Manitoba by testing the soils and investigating the conditions where fills and bridge abutments have failed in the past. Much investigation has already been done, and other contributors to this discussion, engaged in foundation work, may clear up some of these points.

Compaction Tests

An important development in soil mechanics has been the establishing of the relationship between moisture content, density, and compactive effort. The practical application of this was first published by R. R. Proctor in 1933 from observations on dam construction in California. The relationship is essentially that for any one soil, using the same compactive effort throughout, the density increases as the moisture content increases up to a point termed optimum moisture. Increases in moisture content beyond this point cause the resultant density to be lower. This is shown in Fig. 2. If the compactive effort is increased, a similar shaped curve is obtained with a higher maximum density and lower optimum (Curve II in Fig. 2).

A standard method of compaction has been adopted by the A.S.T.M. and the degree of compaction obtained by the test was correlated to the densities obtained in construction by the equipment in use at that time. With improvements in equipment, however, more efficient compaction is now possible, and many state departments have modified the test to obtain higher densities and lower optimums, thus higher degree of subgrade support.

The use of the test determines in advance the density to be obtained in the field and the moisture content at which it can most economically be produced. At maximum density and optimum moisture, the soil has a maximum of solids and a minimum of air voids for the particular compactive effort, and offers the greatest resistance to penetration of water. In a series of laboratory experiments conducted on four type soils ranging from silty clay loam to a heavy gumbo clay, samples were compacted to the densities and moisture contents as shown in Fig. 3:

A—Below maximum density and less than optimum moisture

B—At maximum density and below optimum moisture

C—At maximum density and optimum moisture

D—Below maximum density and above optimum moisture

The samples were then subjected to a capillarity test and the data obtained are given in Table I.

The conclusions reached are as follows:

1. Samples compacted at less than optimum moisture, whether at maximum density or lower, absorb water freely and lose density.

2. Samples compacted at optimum moisture to maximum density resist absorption of water and retain density.

3. Samples above optimum moisture are not affected by capillarity but have lower density.

These data point out to the advantages of a well compacted subgrade, but also are evidence of the critical nature of moisture content. On a concrete

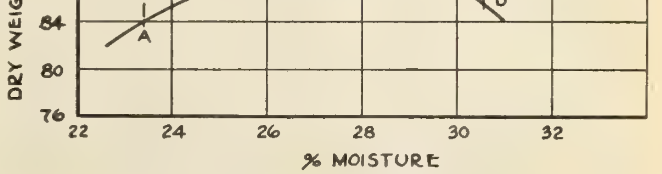

Fig. 3—Typical points of compactions for laboratory tests on compacted samples.

TABLE I

EFFECT OF CAPILLARY ACTION ON TYPES OF SOILS AT THE DEGREES OF COMPACTION SHOWN IN FIG. 3

Soil type	Mech. analysis			Physical anal.		Point of compaction	Before capillarity		After capillarity	
	Sand	Silt	Clay	L. L.	P. I.		Moist. cont.	Density lb.–cu. ft.	Moist. cont.	Density lb.–cu. ft.
						A	10	106	24	98
Clay loam L-247	10	68	22	34	..	B	10	112	22	104
						C	14	116	15	114
						D	19	108	20	106
						A	8	116	18	108
Light clay L-178	33	32	35	24	9	B	7	121	16	114
						C	12	122	13	120
						D	15	117	15	117
						A	24	85	42	78
Heavy clay L-173	16	14	70	82	54	B	24	88	43	76
						C	28	90	33	88
						D	32	86	34	85
						A	10	105	23	102
Silt clay L-245	12	55	33	28	8	B	10	112	23	104
						C	14	116	15	115
						D	17	112	19	111

paving project, where the subgrade was a heavy gumbo clay similar to L-173 in Table I, the subgrade was compacted to a depth of one foot. On one section, when forms were in place, and the density of the subgrade measured to be 94 lb. per cu. ft. at 22 per cent moisture, a heavy rain covered the section with ½ in. of water. When the water could be drained off, the grade was examined and found to be soupy to a depth of ½ in. Below this layer, the density and moisture content remained unchanged. In contrast, on another section of highway where compaction was specified without moisture control, the embankment was constructed in hot, dry weather and compaction difficult to obtain. Under heavy construction traffic however, the top layer reached a density of 86 lb. per cu. ft. at 15 per cent moisture. Before the surface course was constructed, heavy rains occurred and through absorption, the density taken at identical location had dropped to 69 lb. per cu. ft. at 25 per cent moisture content. This condition of poor compaction at a high moisture content produced a very unstable grade.

The ideal condition would be, of course, to compact to such a degree that the optimum moisture was below the plastic limit. In this case the soil would be semi-rigid and thus would have greatly increased supporting power. Experience in highway construction in Manitoba has shown that the densities obtained with normal construction equipment range from 90 to 110 per cent of those obtained in the standard density test. The State of California determine maximum density and optimum moisture on a compaction test using 2000 lb. per sq. in. pressure but base the design on the density retained after immersion in water until swell is complete. In a recent issue of *Roads and Streets* an article was published on the use of a super sheepsfoot roller with an 8 ft. diameter drum, 10 ft. length, 18 in. depth of tamping feet and with a gross weight of 77,000 lb. This roller was used on airport construction to obtain a much higher degree of compaction than determined by the standard test. This procedure of compacting to extremely high densities should be studied carefully as, if after some years of service the soil did absorb moisture, the resultant swell would be serious. With rigid pavements this would be particularly serious as maximum expansion of the subgrade would occur at the joints where it is possible for surface water to enter the subgrade. According to the theory of the moisture-density relation this expansion should not occur. From Fig. 4. if curve I represents the moisture-density curve at standard compaction, and II and III curves for the same soil with increased compactive effort, while the optimum moisture content decreases with increased compactive effort, the relation between the zero air voids curve and the peak density of each curve is quite constant. From this it would appear that the resistance to further moisture penetration would be the same for each maximum density and optimum moisture.

Conclusions reached from theoretical concepts are not always proved in construction, and the proper method of determining the permanency of compaction is by field observations. From laboratory studies, samples compacted at optimum moisture and maximum density when subjected to rapid cycles of drying and rewetting soon revert to the normal field density before compaction. In practice this condition can occur only on the slopes of embankments. Under the surface of the roadway where maximum support is required, on the basis of numerous observations over a six-year period, there is little possibility of a subgrade drying out to develop shrinkage. Such fluctuations in moisture content as have been noted are slow and not disruptive.

In northern climates, however, frost action must be considered in effecting the permanency of compaction. In a soil compacted to maximum density at optimum moisture, each solid particle is surrounded by a film of moisture and there is a minimum of air voids in the mass. In freezing, the water expands 9 per cent in volume which should swell the mass causing a density loss on thawing. What the action of freezing is on compacted soils is not clear to the author. The facilities of the department's laboratory do not permit investigation of this feature and, to date, the author has seen nothing published on the subject. A very thorough study of permanency of compaction has been made by H. G. Porter of Texas State Highway Department, but unfortunately he was not concerned with frost action. Field observations have been made on densities in constructed embankments. The results of one such series of observations are given in Table II.

Such data is too meagre to reach any conclusions on permanency of compaction but is presented here as being the type of data which should be collected in order to correctly evaluate the effects of compaction.

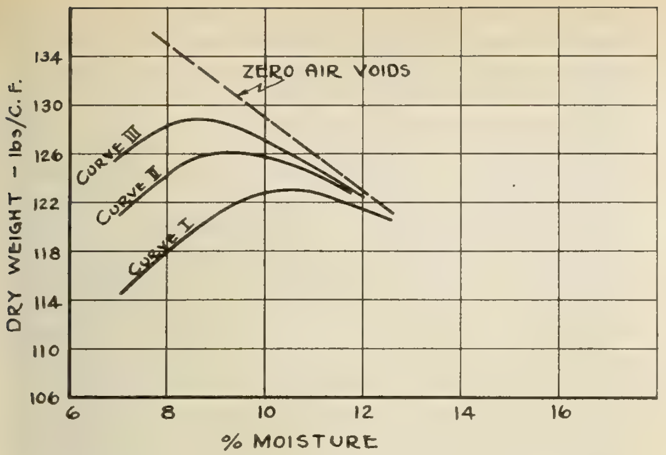

Fig. 4—The relation between compaction curves and zero air voids.

Frost Boils

No paper on soil studies applied to highway construction would be complete without reference to the problem of frost boils. In this paper only one type will be considered. Problems involving free water may be cured by drainage. The type of drainage and location of the pipes is peculiar to each set of conditions, and solution can be determined only by observations and auger borings to determine water levels and seepage zones. The problem of frost boils from a soils angle has to do with certain soil types occurring in poorly drained areas. In an investigation conducted in Manitoba, from 1940-43, on numerous frost boils occurring in the Winnipeg area, the soil condition was found to be a pocket or layer of silty clay or loam occurring in the heavy gumbo clay. The action of the frost in these soils was observed in the field. After freeze-up in the fall of 1941, moisture contents were determined in the gumbo clay and silty clay layers. They were respectively 30 and 24 per cent. The frost penetration at that time was from 6 to 12 in., effectively eliminating the possibility of precipitation and run off water entering the soil. The same locations were examined in February 1942 when the frost penetration was 5 ft. At that time the silty layers were found to be laminated with fine ice layers 1/16 in. thick and spaced from ¼ to ½ in. apart. The moisture content of the heavy clay remained at 30 per cent, but the ice laminated silty clay layer had increased to 39 per cent moisture. This is an increase, due to frost action, of 15 per cent moisture and for this soil changes it from a plastic to a liquid state. The moisture contents in the layers were confirmed by samples taken from the silt extruded from the frost boils occurring the following spring. These averaged 35 per cent. The heavy clay soils while frozen showed no indication of ice segregation or moisture increase.

The physical phenomena on which ice segregation is dependent, are as follows:

1. The ability of water particles in soil pores of relatively large diameters to freeze at, or slightly below, normal freezing temperatures.

2. The ability of water in the fine soil pores to resist freezing until the temperature is reduced to a point below that at which the water in the large pores freezes.

3. The ability of water particles, when freezing in the large pores, to draw to themselves unfrozen water from the finer capillaries, thus causing increases in volume.

The critical factor in the soil, which determines whether ice layers will develop, is the pore space. The pore space must be small enough to have capillary properties. It must be large enough to have rapid capillarity and a flow from the small pores to the freezing water in the larger pores. There must be sufficient water reserve that the water from the fine pores may be replaced.

The soil condition described previously satisfies these requirements. The heavy gumbo clay has high ultimate capillarity, but resistance to flow is so great that water particles tend to freeze in the dispersed state. The layer of this clay below the silt acts as a reservoir while freezing action takes place in the silt layer. The pore space in the silt layer maintains the nice balance between capillary rise and flow necessary to build the ice layers.

From the description of the action, it is obvious that drainage would not be an effective remedy unless it were possible to lower the water table to such an extent that the gumbo layer could not furnish the necessary moisture for capillary action in the silt. In the level, poorly drained, areas adjacent to Winnipeg, improved surface drainage helps but cannot be depended on as a solution. A wet fall will leave the heavy clay in a saturated condition with water standing in the ditches. The only satisfactory solution is in identifying the frost heaving materials and removing them from the grade to a depth below frost penetration, or to such depth that the heave and subsequent boil action does not affect the surface. From observations made to date on frost boils, bituminous mats and base courses have been completely destroyed by frost action in silt layers at 30 in. depth below the surface. In none of the boils examined has the depth of silt layer been greater than this. On a concrete pavement, no detrimental frost action has been observed on a section where the silt is from 40 to 60 in. from the surface. On another concrete section, there has been heavy cracking of slabs over silt pockets from 30 to 35 in. from the surface. Because of variables in pavement design on the various sections, it is difficult to draw sound conclusions from these comparisons; however a standard has been adopted for new construction requiring removal of frost heaving soils to 4 ft. below grade line. The backfill used is a suitable clay soil. Backfills of permeable materials are not used because of the difficulty in obtaining drainage from the pockets. On a recent project, this standard required subcuts from prairie elevation, before starting embankment, of 2785 cu. yd. per mile. During construction of the embankment, a soils inspector was employed to ensure that silty material occurring in the excavation area was not placed in the embankment but used for flattening the slopes.

TABLE II

OBSERVATIONS OF DENSITY AND MOISTURE CONTENT ON HEAVY CLAY SUBGRADE

Date	Dry density lb./cu.ft.	Moist. cont. %	Conditions
Oct. 1942	101	20	Embankment completed.
June 1943	90	27	The embankment was not protected with any type of surfacing over the winter.
Sept. 1943	91	27	Observations immediately preceding construction of the base course.
June 1944	98	24	The increased density is due to compaction by trucks hauling base course material.

From the experience to date, the most troublesome frost heaving soils range from a fine blow sand (100 per cent passing No. 10 mesh and 5 to 15 per cent passing No. 200 mesh) to silty loams and clay containing less than 10 per cent retained on a No. 10 sieve and less than 35 per cent clay.

As a maintenance problem on surfaced highways, the removal of silt pockets presents a difficult operation from the standpoint of cost and inconvenience to traffic. Some highway departments have been treating frost boils with chlorides, but little information is available on the effectiveness of the treatment, the quantity of chloride required, the duration of the treatment and the best method of application. In laboratory experiments at Purdue University, the addition of 1 per cent (by weight of dry soil) of chloride to silt soils prevented the formation of ice lenses, and the Highway Research Board has formed a committee to study this treatment. A number of state highway departments are co-operating in the study with experimental sections. In Manitoba, an experimental section has been under observation for two winters but, to date, results have not been entirely satisfactory. On this section, holes were drilled through the surface at spacings varying from 8 to 4 ft. centres and filled with 30 lb. of chloride. The section with holes at 4 ft. centres was better than the untreated portion, but some failures occurred. The experiment is being repeated and qualitative tests for chloride will be made on soil samples at various spacings from the chloride holes to determine the migration of the chloride. This treatment is well worth investigating as a possible solution for a difficult maintenance problem.

Surface Design

In the original condition surveys undertaken by highway departments, it was early seen that an expensive high type of surface was poor economics and no solution for a poor subgrade. Unfortunately, within small limits, it is impossible to pick and choose subgrades. The engineer has to make the best of the soil conditions encountered. The obvious solution was to insert a foundation layer, the base course, on the prepared subgrade. The purpose of the base course is to distribute the load to such a degree that the subgrade is not overstressed. The base course must be a material of greater bearing than the subgrade soil and be constant in its support, i.e. a "stabilized" material which will not lose support through moisture absorption or frost action. Any material which supplies this function is suitable for a base course, and the action of compacting the subgrade is in itself a process of stabilization. The stabilization methods in use and the resulting types of base courses are numerous, and in this paper only a few with which the department has had experience, or has been investigating, will be mentioned.

Stabilized Gravel Base Course

This is the most common type of base course and is essentially a combination of granular material and binder soil. The granular material supplies internal friction, and the binder soil gives the cohesion which holds the granular particles in close contact so that the mass develops the maximum shear strength. This is the old practice of adding gravel to clay subgrades and clay to sand subgrades. With the advent of soil testing and the correlation of the tests to service records, it was soon realized that the grading of the combinations of granular and cohesive materials and the type of cohesive fraction of the mixture was most important. Years of observation have resulted in the determination of grading curves and limits for the physical properties of the soil fines fraction to give best service. In rare cases, the subgrade is in itself a stable material and all that is required is compaction. Where the subgrade is a light soil, satisfactory for binder, careful scarifying and addition of granular material will provide the required base. However, the addition in uncontrolled quantities, of granular material to a clay subgrade unsuitable for binder will not produce a stable mat. On No. 1 Highway, 4000 cu. yd. per mile of relatively clean gravel were added to a heavy clay subgrade. This material was worked into the grade by traffic and scarifying. As a gravel road, the surface was satisfactory. This section was subsequently surfaced with a 4 in. bituminous mat. After two years, failures occurred and examination of the failures showed that the gravel crust varied in thickness from 1 to 4 in. at a moisture content of 5 per cent. The subgrade clay was at a moisture content of 30 per cent. Further examination showed gravel particles as deep as 18 in. but very little of the granular material which had been added was acting as an effective base course. In contrast, west of this section the subgrade soil is a sandy clay. The construction followed the same procedure, and at present there has been little maintenance. The examination through the grade showed the gravel portion to be confined to a layer 4 to 6 in. thick on top of the subgrade, well knit together and supplying real support. On clay subgrades, the base course should be a graded material including fines which will compact to form a mat. With the use of porous, open graded gravels or crushed stone, the clay subgrade works into the voids and acts as a lubricant destroying the internal friction on which this type of base depends for strength. The thickness of the base is reduced by the depth of clay penetration. This fact holds for the case of stage construction in which the granular layer is first used as a surface and, later, a higher type surface is constructed utilizing the granular layer as a base course. The use of the open graded gravel or crushed stone base is not practical in stage construction unless subgrade penetration does occur. The material containing no cohesive fraction cannot develop the internal friction unless confined and would displace under traffic, thus causing a loose surface.

As a base course on which some type of surface is constructed immediately, the open graded material is confined so that it develops its internal friction. To obtain the confining effect necessary, these bases have been trenched into the subgrade. This is poor practice as the base course becomes a reservoir for the collection of water seeping through surface cracks or at the edge of the surface treatment. The presence of this moisture softens the subgrade, further reduces the supporting power, and may cause serious frost heaving. These trenched sections can be improved by drainage through the shoulder by means of pipe, but to be effective the subgrade has to be perfectly shaped and remain so, and the pipes require constant maintenance. The best section is obtained by carrying the porous layer out to the slopes and surfacing the shoulders with a stabilized gravel layer. This extends the confining effect out beyond the edge of the pavement where the load occurs.

In the stabilized gravel base, the grading from coarse to fine provides a dense material with a minimum of voids. This material compacts to form a mat on the subgrade and there are no voids for the clay to penetrate. The cohesive fraction holds the granular particles together so that the shear strength can be developed even in an unconfined state. Any confining influence of the surface, as occurring in open graded bases, enhances the strength of the stabilized mat. This type of base is ideal for stage construction as, by the use of deliquescent chemicals to retain moisture content, it will provide a good surface for light traffic. It is important to note that the use of the chemicals themselves will not stabilize a gravel surface. The chemicals will only retain the moisture so that the water films on the cohesive of the mix will be able to hold the granular material together. The surface mat must be properly graded and contain suitable soil fines for chloride treatment to be effective. The main criticism of this type of base is that, because of the fines contained, the base is subject to capillary action. The degree of capillarity is limited by the grading and the plasticity index of the mix. Under adverse conditions of a very wet subgrade, moisture content 30 per cent, the stabilized base will reach a moisture content of 4 per cent at which its shear resistance is low. It is difficult to obtain a comparison of the strength of the stabilized gravel at this moisture content, to the strength of the non-cohesive granular material. In comparative laboratory tests, the non-cohesive bases show to best advantage because, due to laboratory limitations, the non-cohesive material is rigidly confined in a container, a condition which is not duplicated on the road with the plastic subgrade and flexible surface. In addition, it is possible to waterproof the stabilized mixture by adding a small percentage of bitumen to the mix.

On Provincial Trunk Highway No. 1 West, a stabilized base course, waterproofed with an admixture of 1 per cent SC-1 asphalt, was constructed in 1939. The subgrade on the 39-mile section varies from a heavy clay to a fine sand and the moisture content in the base course has ranged from 1.6 to 3.0 per cent, averaging 2.3 per cent. At this moisture content, the base has a real shear strength even in an unconfined state. The Quebec Highway Department has used lignin (waste sulphite liquor) as an admixture in stabilized bases. In Manitoba, some laboratory experimental work has been done on lignin admixtures. From this work it appears that the addition of lignin gives an increased strength to the mixture in a dry state but, as it is soluble in water, the lignin has no water-proofing effect. At the normal moisture content of 4 per cent, the lignin treated mix showed no increase in strength over the untreated mix. The lignin admixtures may, as do the calcium-sodium chloride admixtures, have a beneficial effect on stabilized mixes, used as surface courses, in aiding moisture retention and thus preventing loss of fines. From our laboratory compressive strength determinations and field observations, however, there does not seem to be any particular advantage in these admixtures for base courses.

In the base courses described, the principle has been to supply granular material in order to provide internal friction. Other base courses are of a type in which a relatively small percentage of a stabilizing agent is added to the soil in place to change its characteristics. The stabilizing materials most commonly used are cement, asphalt, asphalt emulsions, tar, and resins. In Manitoba, these processes have not been used to date, but the development has been studied for possible future use. A brief description of some of the common treatments is given below.

Soil Cement Stabilization

This type of stabilization is only suitable for certain types of soils. The limits of the soils as recommended by the Highway Research Board are as follows:

Grain Size

Passing No. 4 sieve	at least 50%
Passing No. 40 sieve	15-100%
Passing No. 200 sieve	not more than 50%

Physical Tests

Liquid limit	not more than 40
Plasticity index	not more than 18

The cement requirement ranges from 8 to 14 per cent by volume of soil and is determined by standardized tests—consisting in wetting and drying, and freezing and thawing—on cylinders at various cement contents. The cement and pulverized soil are mixed in place and water added to bring the mixture to the optimum moisture for compaction.

Bituminous and Tar Stabilization

The process in this type of stabilization consists of mixing cut back asphalts, asphalt emulsions or tar, into the subgrade. In cohesive soils, the action is to waterproof the material from capillarity. In granular soils, it provides cohesion. The soil is pulverized and water added to a predetermined optimum, usually lower than the standard test. The wet mixture is sprayed with asphalt or tar thoroughly mixed and compacted. The percentage of bitumens required is determined by stability tests and water absorption tests on samples containing various percentages of the stabilizing agent. The percentage varies greatly and is critical, as an excess will greatly reduce stability. This type of treatment is confined to loams and fine sand, the sands frequently requiring the addition of filler. Its use in heavier soils requires high percentages of bitumen and it is almost impossible to obtain the intimate mixture required. This type of stabilization is limited to areas where a hot, dry construction season can be depended upon, as the mixture of soil, water, and asphalt is slow to cure. In North Dakota it required six weeks for a 4 in. base to cure sufficiently for construction of the surface.

Resin Stabilization

The water-proofing of soils with resins is a relatively new process. It has been used since the war by the U.S. Army for parade grounds and, it is thought, on some airports overseas. Some work was done on this treatment by one of the southern highway departments but little information is available on its performance. In the Manitoba Department laboratory, experiments were made with the resin Stabinol. One per cent by weight of dry soil, of the powdered resin added to loam soils was found to be very effective in water-proofing. No capillary action was observed in a treated sample over a period of six weeks, while complete slump of untreated samples occurred in one hour. In heavy clays treated with 2 per cent Stabinol, some capillarity and swelling of soils did occur. The use of the resin treatment will only be applicable to soils with low shrinkage characteristics. In order to compact the treated soil water must be added, and, to develop supporting value, the mixture must dry out during a curing period. From the observation of treated laboratory samples of clay, the cracking during the evaporation of moisture would destroy a base course.

The selection of the type of base course to be constructed is largely a matter of economics. In Manitoba, because of the available deposits of gravel the development has been towards granular stabilized bases. For post-war construction, however, the balance between shipping large quantities of gravel and using small quantities of the relatively expensive stabilizing agents will have to be made in selecting the type of base course.

As the mileage of highway construction increases and gravel resources diminish, the chemical and bituminous types will be more important.

Design of Pavements

The most controversial point in highway design at the moment is the relation between load, surface, base course, and subgrade. This is a straight problem in soil mechanics as the governing factor is the supporting value of the subgrade. The magnitude of the load is governed by law, and the surface and base course must be designed to ensure that the bearing value of the subgrade is not exceeded. From the advances made in measuring structural strength of soils in foundation engineering, the problem does not appear too difficult. To use these strength measurements in a design correlating load, surface, base and subgrade is, however, a most difficult problem as the distribution of the load to the subgrade and action of the subgrade in failure is complex. In addition, the relatively shallow depth involved in highway design is subject to variations due to weather which do not occur in foundation design. In studying this problem, some investigators have applied the Boussinesq theory of stress distribution in soils. This theory has been generally adopted for foundation work, and is based on the assumption that the soil is homogenous and semi-elastic. Actual stress measurements have indicated that the distribution given by this theory is reasonably accurate for foundations where the load is uniformly distributed by a rigid footing directly to the soil. In highway design the influence of surface and base layers, of entirely different rigidity, between the load and the subgrade has not been satisfactorily determined. These factors have limited the use of structural strength measurements of soil in design.

The practice in most highway departments is to adopt standard designs of surface and base course for the various soil types and conditions existing in the area. These standards are based on their experience as to what has been satisfactory in the past. The development of the soil tests has permitted more rational use of the experience in that the governing factor of the design, the subgrade soil, can be identified. With this identification, the knowledge and practice of other states and provinces can be evaluated for use in the particular soil conditions and climate concerned.

Flexible Pavement Design

Several states have adopted arbitrary tests on subgrades to use as a comparative rating of subgrade support. These tests are usually a measurement of the resistance to penetration of a point or, in field bearing tests,of the load required to produce a standard penetration of a steel plate. The California Highway Department has developed, and had in use for a number of years, a comparative rating test, This test rates soils on the basis of resistance to penetration of a 3-sq. in. plunger on a sample confined in a 6 in. diameter steel mould. The value is expressed as the ratio of the load determined on the sample to the load required for equal penetration in a sample of standard crushed stone. Curves have been developed, based on the California experience, for highway wheel loads relating the bearing ratios to thickness of surface and base course required. This test was adopted with modifications by the United States Engineering Department for the design of the many airports constructed during the war emergency. This test was adopted as being the most reliable, and, by extra polating from California highway experience, curves for wheel loads up to 75,000 lb. were developed.

From tests in our laboratory using the U.S.E.D. design for highway wheel loads, the total depth of base and surface required on gumbo clay is greater than 30 in.; in fact it runs off the prepared charts. This base course would not necessarily be all granular material, but selected borrow could be used in the lower layers and progressively better material towards the surface. The design requires a minimum 80 per cent California bearing ratio for the top 6 in. which would be a confined crushed stone or stabilized gravel. The California design is convenient for practical application; it is based on a sound soil mechanics concept in permitting the base course material to decrease in quality as depth from the load increases, but the method of rating materials is subject to criticism. Samples to be tested are compacted and soaked in water before determining the bearing ratio. This condition of test would be suitable for some particular condition but it is not applicable to general design. From our field observations this condition of saturation rarely occurs in Manitoba and, thus, the test would have to be modified for our use.

In the field bearing test, the values obtained are applicable only to the moisture and density conditions under which the test is conducted. The conditions existing at the time of the test may alter when the subgrade is surfaced and put into service. The use of a rigid plate in these bearing tests is also open to criticism as, on a cohesive subgrade, stress concentrations occur at the perimeter of the plate causing failure in punching shear. Actual pavement failures occur through deflection of the surface due to consolidation and plastic displacement of the subgrade when overloaded. If the test does not produce the same type of failure as the wheel load, it is not a satisfactory method of comparison.

The use of the various bearing tests by numerous highway organizations is compiling a wide range of data which will be valuable in future development of a rational design. The general practice at present is based on experience. The results of a co-operative study by the Highway Research Board, Bureau of Public Roads and Asphalt Institute on state practice in flexible pavement design, has been published in a wartime bulletin, December 1943. This bulletin gives recommended thicknesses for base and surface, under 10,000-lb. wheel loads, for each soil type in the Bureau of Public Roads classification.

Rigid Pavement Design

There is an impression among engineers that any surfacing problem is automatically solved with the construction of a concrete pavement. This is based on the rigidity of the slab giving a much higher distribution of load to the subgrade than is possible in a flexible surface. It does not follow that subgrade investigations can be ignored in concrete paving design. On the contrary, preliminary surveys are all the more important as trouble from poor compaction and failure to remove frost heaving materials is very expensive to correct once the pavement is laid. The rigidity, while providing load distribution, introduces other problems such as cracking occurring in slabs, which reduces the bearing area and increases subgrade pressures. With the rigid material, shrinkage cracks and stresses from temperature changes require provision of joints in design and constitute planes of weakness for possible failure. The condition is aggravated by surface water entering the subgrade through the joints and reducing subgrade support at the weakest plane.

The design of concrete pavements, as most other phases of highway work, has developed from experience rather than mathematical theory. The experience has been supplemented by experimental test roads in which varying cross-section and depths of slab were used. Most highway departments have adopted certain standard sections of thickened edge or uniform slab design on the basis of what has been satisfactory in the past or is in use in other states. Where subgrade soil conditions are particularly poor, the usual procedure is to supplement the standard section with a base course. This has been found good practice on expansive clays to prevent mud pumping and distortion at joints. On clay subgrades, the California Highway Department specifies a 12 in. base course, with a minimum bearing ratio of 20 per cent under concrete pavements. On Manitoba highways 9-6-9 and 10-7-10, concrete sections have been used on clay subgrades without base courses. These sections have been satisfactory but the slabs are well reinforced with bar mats and all joints provided with dowels for load transfer between slabs. The reinforcement is insurance to hold the slab together if cracking develops.

Design formulae for concrete slabs do exist but, in these formulae, a value for the modulus of subgrade traction K is required for solution. Unless this subgrade value is determined, the use of the formula is based on an assumption. The inability to evaluate K has limited the use of design formulae. In airport design, where no past experience was available on the tremendous wheel loads to be provided for, evaluations of K had to be used and the development of field bearing tests on this work will possibly clear up many uncertainties.

In selecting the type of pavement, with thorough soils investigation, a satisfactory design of either rigid or flexible type may be made. The selection rests on the comparative cost of the high type rigid surface to the cost of the light bituminous surface and heavy base course. The cost, in turn, is governed by the availability of materials. In poor soil areas where aggregates are not available, less material is required for concrete pavement and the cost is lower. On the other hand, for concrete, the type of aggregate is critical while, for base courses, gravel containing shale, clay and other materials making it unsuitable for any other purpose may be used. These material details are usually the governing factor in the type of design selected.

Conclusion

In this paper, the development of highway design has been stressed as depending on past experience. This is an excellent criterion but it only holds for the conditions of service under which the experience was gained. In the future, loads and traffic conditions will change and to build only to present standards is not sufficient. In order that design for future traffic may be made, work on soil mechanics must progress in determining stress distributions involved in highway loadings. A wonderful opportunity is now available in this field through observations on the recently constructed airports.

DISCUSSION

W. F. Riddell, m.e.i.c.[1]

Referring briefly to Mr. William's paper regarding the formation of ice in silt layers, the flow of moisture to the ice lenses forming in the silt is probably other than capillary flow. The adhesive and cohesive films of water surrounding and connecting the individual soil particles provide a most probable channel of flow at temperatures considerably below freezing and may even operate after apparent freezing of a considerable depth of " gumbo " below the silt layer.

R. M. Hardy, m.e.i.c.[2]

Mr. Williams' paper has been of particular interest in its description of the procedure being followed in Manitoba in dealing with soil problems on highway construction. The paper covers a lot of ground in a comparatively short space. A writer on soil mechanics making such an attempt sets himself a very difficult job. It is always comparatively easy to write a rather critical discussion of such a paper.

The following comments are submitted with a full realization of this point and are not intended to detract in any way from the merit of the paper.

In the section dealing with structural strength tests, the use of the term " settlement tests " to describe the " consolidation test " is unfortunate. This test merely attempts to determine the consolidation characteristics of a soil for use in Dr. Terzaghi's theory of consolidation. The process of consolidation is only one of several factors that may govern the actual settlement of a structure or embankment.

Mr. Williams in his section on shear tests deals with the " direct " shear test. It will be unfortunate if the impression is created that some of the disadvantages of this type of test are inherent in all types of shear test equipment. There has been more work devoted to the development of shear test equipment for soils than to any other single soil test. Space will hardly permit even listing the various types that have been used. Two disadvantages inherent in the direct type of shear test are of particular significance. First, the method of holding the sample produces a non-uniform distribution of stress in the soil, which is quite indeterminate. This is most objectionable when a soil is tested that shows the characteristics indicated in his Fig. 1, in which there is a large decrease in shearing resistance after a maximum value is reached. All parts of the sample do not reach the maximum shearing stress at the same time and so what is called progressive failure results. Second, the exact stress conditions on an element of soil within the sample are never accurately known and cannot be controlled.

Both of these disadvantages are overcome in the type of shear test equipment known as the triaxial compression device. In a test run with this equipment the stress conditions are known, they can be controlled, and deformation of the sample can be measured with reasonable accuracy. Moreover, volume changes can be measured and, for cohesionless soils, critical densities can be determined. These latter are factors of considerable importance under some circumstances, and are not capable of determination in the direct shear test. The claim is frequently made that the triaxial test requires a much greater time than the direct shear test. In the Soil Mechanics laboratory of the University of Alberta we have run close to 200

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"quick" triaxial shear tests on cohesive soils in the past three years. The average time per test is about one hour to secure the same data as one gets from a direct shear test.

It should be noted that Mr. Williams' comments regarding ultimate shear strength, rate of application of load and so forth in shear tests apply only to cohesive soils. They are not important factors within practical limits for tests on cohesionless soils. It should also be noted that the large drop in shear strength after reaching a maximum stress as indicated in his Fig.1 is a rather extreme example. Such a large difference does not usually occur.

We are unwilling to agree with Mr. Williams that "there is little possibility of a subgrade drying out to develop shrinkage". There have been many examples in the west of damage to buildings due to soil shrinkage. Moreover, the writer knows of one case of a concrete runway recently constructed, for which cracking can only be explained on the basis of subgrade shrinkage. Until observations have been continued over a drought period, it is considered unwise to come to such a conclusion.

This writer is puzzled by Mr. Williams' Fig. 4 and his discussion pertaining thereto. These seem to be at variance with the curves in Fig. 8, of Mr. Peterson's paper*. Mr. Williams' comments on this would be appreciated.

The section on Frost Boils is of particular interest. Mr. Williams explains the physical phenomenon of ice segregation along the same lines as C. A. Hogentogler in his well-known book "Engineering Properties of Soils".

The pioneer research on the mechanics of frost action was done on this continent by Dr. Stephen Taber of the University of North Carolina. His results were first published in the 1929 and 1930 volumes of the *Journal of Geology*. His is the accepted theory in Europe as well as on this continent. Benkleman and Olmstead 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.

Hogentogler's presentation differs from Taber's hypothesis in that, instead of the drops of water in voids of varying size having different freezing temperatures, it is the water adsorbed as thin films on the surfaces of the soil particles that has a lower freezing point than the water occupying the bulk of the void spaces. These adsorbed films are of the order of only a comparatively few layers of molecules in thickness. They are thus of a different order of dimension than average pore diameters. No physicist will admit a difference in freezing temperature for water at the centre of void spaces of different sizes in a soil.

Mr. Williams' conclusion for his frost boil example that the gumbo clay below the silt pocket acts as a reservoir to supply water to the silt is not a reasonable conclusion from Taber's hypothesis. The ice lenses can only form in the silt at a rate consistent with the flow of water through the clay. Moreover, for the same rate of penetration of the frost line precisely the same thickness of ice lenses would form in the clay as in the silt. To get ice segregation in the silt and not in the clay would require a slow penetration of frost line through the silt and a much faster penetration through the deeper layer of clay, a thing quite inconsistent with all published ground temperature readings in frost areas. Taber's theory leads to the conclusion that the source of water for the growth of ice lenses is the silt bed itself. That is, it is either water bearing or the water is drawn from unfrozen silt adjoining the frost boil. This conclusion may suggest an alternative method for correcting the frost boil condition.

The factor of rate of penetration of the frost line is exceedingly important. It is the principal reason why the effects of frost action vary so widely from year to year. In a "severe" winter, with a cold spell early in the winter, the frost line penetrates relatively fast, resulting in very thin ice lenses near the surface. For this reason, contrary to popular opinion, our comparatively "severe" winters in western Canada result in less damaging frost action than ordinarily occurs in many parts of eastern Canada and the eastern States.

Sieve analysis, as a method of identifying soil types particularly susceptible to frost action, may be quite misleading for some soils. Dr. A. Casagrande after considerable study arrived at the conclusion that the critical grain size is about 0.02 mm., a size much smaller than the 200 mesh sieve. He has stated that considerable ice segregation can be expected in non-uniform soils containing more than 3 per cent, and in very uniform soils more than 10 per cent of grains smaller than 0.02 mm. It is of some practical importance to note that a well graded bank run gravel may be susceptible to frost heaving with a silt or clay content of only 3 per cent, a quantity of fine material simply making it appear as a "dirty" gravel.

Preliminary tests in our laboratory treating a silt with aerosol, a wetting agent similar to stabinol, show it is quite effective in preventing ice segregation in the zone of capillary saturation.

In conclusion we would like to point out that there are many problems involving frozen ground that still need investigation. Vast areas in northern Canada are underlain by permanently frozen ground—"permafrost". The stability of foundations for runways and buildings on permafrost is a matter worthy of some research by Canadians.

I. F. Morrison, M.E.I.C[3]

It is noted that no references are given in Mr. Williams' paper to the various sources from which a number of the statements have perhaps been drawn and it is, therefore, presumed that the author has presented them in modified or restated form and therefore assumes responsibility for their validity and accuracy.

In Fig. 1 of the paper, it is difficult to see the connection, on the graph, between the vertical line labelled $S=P \tan \phi + C$ and the shear-stress deformation curve. It is suggested that it would have been better to omit the equation. In reference to Fig. 4 of the paper, the author refers to "the relation between the zero air voids curve and the peak density of each curve". It does not appear clear just what is meant by "relation" nor is any explanation offered as to whether this is so for all cases. For it would appear that this is intended to be a generalization.

In the section on Frost Boils, the part which describes the physical phenomena appears to contain some obscurities which the author might well clear

*Soil Mechanics as Applied to P.F.R.A. Problems with Special Reference to the Proposed St. Mary Dam, by Robert Peterson, Jr.E.I.C., p. 274.

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up in subsequent discussion, and one gets the impression that perhaps he has attempted to deal with a rather involved subject by methods not adequate for a carefully written explanation of the physical phenomena with which he is dealing.

What, for instance, is meant by "water particles"? On what evidence does the author base his statement that water in the fine soil pores resists freezing? And just what is meant by the freezing of the water particles in the dispersed state?

Such statements do not appeal to the writer as conducive to clear thinking. Perhaps the author can set him right on these points.

J. A. Wilson, M.E.I.C.[4]

Mr. Wilson felt that a knowledge of soil mechanics was of vital importance to many civil engineers engaged in highway and airport work, and its discussion at the meeting had been most timely. He traced the development of Canadian airports through the various stages of the turf field, which was unusable in wet weather, to the pavements laid for the trans-Canada service on the main city airports, and its enlargement in the Commonwelath Air Training Plan.

The present pavements were built to carry only the weight of lighter types of aircraft up to, say 30,000 lb. The future pavements must provide for all-out weights of up to 90,000 lb. for domestic services and, in the case of trans-oceanic service, up to 140,000 lb. This means that the pavement on many of the principal airports in Canada must be strengthened in the near future. It will also require to be lengthened in many cases. The expenditure would inevitably be heavy, running into several million dollars across the Dominion. It was essential, before construction work started, that there should be a sure basis on which to calculate the bearing strength of the airport soils. The pavement was only as strong as the sub-soil on which it rests.

Reference had been made in the discussion to the well known California formula which apparently was the basis on which United States engineers were working at present. The engineers of the Department of Transport are not prepared to accept this formula as a satisfactory basis for practical work, though it might be satisfactory for conditions existing in California. Experience had proved that, under Canadian conditions, it did not provide a satisfactory basis for practical application.

Further study and research on this important problem was an urgent necessity and Mr. Wilson was delighted that so much attention was already being paid to it, and that so much practical work had been done by the highways departments, the Canadian universities and other bodies.

The engineers of the Department of Transport would be glad to contribute from their practical experience in the building of the numerous airports in all parts of Canada which had been constructed during the war, and would be prepared to cooperate with other organizations in any programme of research which could be organized.

The Author

The paper presented under the title suggested by the Programme Committee was rather all embracing and it was necessary to touch on some subjects more lightly than their importance warranted. Some statements and opinions made in the paper are naturally drawn from a number of publications and are presented as the author's summation of his reading. As such they are subject to criticism and it has been received.

The critical discussion is fairly well confined to structural strength of soil, compaction, and frost action, and I propose to reply by subject rather than individual discussions.

Structural Strength Tests

In reply to Professor Morrison's query regarding the vertical line in Fig. 1 of the paper, it might be explained that the line is dimensional indicating that the magnitude of the shear is equal to $P = \tan \phi + C$. As far as I know this is quite correct but as Professor Morrison is far more conversant than I with the theory of shear stress in soils it may be inaccurate.

Professor Hardy has pointed out that the disadvantages regarding shear tests stated in the paper do not apply to all types of shear test equipment or to cohesionless soils. The experience of our department in this work is practically negligible and the direct type shear machine was selected for a start because it is a simple piece of apparatus, it could be made to fit the standard size laboratory samples (4 in. dia.) used in other equipment such as compaction, capillarity, and penetration tests, and the relatively large diameter sample would permit testing samples containing coarse particles. The triaxial compression device referred to by Professor Hardy is generally accepted as being a more accurate type of test, but most equipment in use will only handle samples up to 2½ in. dia. From such information as I have obtained, the ratio of length : diameter for triaxial test samples should be 3:1 necessitating a very elaborate machine for triaxial tests on the 4 in. sample.

Compaction Data

My statement with regard to the compaction curves in Fig. 4 is, from the discussions, obviously not clear. The relationship between peak densities for each optimum and zero air voids line referred to is that the percentage of air voids in each case would be the same. As stated in the paper it was a generalization and as such is rightly to be criticized as I have no data to substantiate it. In fact the compaction tests shown on Fig. 8 of Mr Peterson's paper show differently. It would have been more correctly stated as a supposition on my part.

Frost Action in Soils

My statement of the physical phenomena, on which ice segregation is dependent, was arrived at from reading publications of C. A. Hogentogler, H. F. Winn, F. B. Mullis, V. R. Burton, A. C. Benkleman and Stephen Taber. I cannot shift the responsibility for the statement on to any of these authors as, what I have stated is my interpretation of their information which I believed fitted the soil conditions and frost action I had observed.

My interpretation does not satisfy either Professor Morrison or Professor Hardy, and the latter has been kind enough to point out in his discussion where I have erred.

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METALLURGY AND MACHINE DESIGN*

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SUMMARY—Modern metallurgy offers many methods of overcoming objectionable stresses in structural or machine parts without having to resort to large factors of safety or "over-design". These methods are reviewed and a brief description is given of the equipment used nowadays for the experimental determination of stress distribution.

In the past, structural and machine design was conducted by employing many empirical formulæ in conjunction with large factors of safety. Modern machinery with its high speeds and high loads has caused us to seek more accurate and more economical means of designing and testing such machinery. In particular, we must be certain that once the parts are put into service there will be neither a design nor a metallurgical failure.

Formerly, much uncertainty existed as to the stresses set up in service and the properties of the materials used. Consequently, large factors of safety (or factors of ignorance) were introduced, with resultant large increases in weight.

We know today that it is not necessary to use expensive high-strength alloy steels or greatly increased sections to cover up for lack of knowledge of what a part will stand in service. It is now possible to chart accurately the distribution of stress over an entire component, or most engineering structures, whether it be made of steel, aluminium, magnesium, or some other material. Consequently, weight can be saved, or cheaper materials used, in the manufacture of any structure because it is possible to specify the proper amount and distribution of material in any part to make it the strongest and most durable design. It has always been realized that the shape of any part and the material from which it is made go hand in hand in determining its performance in service.

The purpose of this article is to discuss briefly some of the problems—generally in the scope of the metallurgist—which confront the designer, and at the same time point out how many of these problems may be overcome by co-operation with the metallurgist. Obviously, few designers are competent metallurgists and, of course, the reverse is also true; thus, the need for this co-operation is stressed. Furthermore, it is desired to present a brief description of several of the new instruments and machines now available to the designing and metallurgical engineers which enable them to develop and prove new designs with an accuracy never before possible. These two subjects, it may be seen, are closely allied.

Fatigue

Despite the fact that improvements in the shape of a part can be accomplished, machine parts which are subjected to repeated loads may fail in fatigue unless the factors which are known to reduce and to extend fatigue life are thoroughly understood. Failed parts are usually returned to the metallurgist for examination, with the implication that the part failed because of a metallurgical defect. In the great majority of cases, failure was attributed to fatigue and the metal was found to be quite sound. Thus the study of fatigue has been thought to be a metallurgical function. In reality, it should be a joint responsibility of the metallurgical, design, production, and inspection departments. Their understanding of the phenomena of fatigue will serve to circumvent failure of parts from this cause.

Although the over-all design of a part may be satisfactory, it is the small, often overlooked features of design which cause failure. Let us briefly examine some of the factors which may cause a crankshaft, a railroad axle, a spring, or a gear, to fail after a relatively few hours of service.

The life of rapidly moving machine parts is greatly reduced by decarburized, rough, scratched, or nicked surfaces; poorly designed fillets; sharp corners; keyways, etc. These sharp edges act as points of local stress concentration, and thus the ability of the metal to withstand a repeated stress is lowered considerably even though the part may have been designed on the basis of the endurance limit[1] of the material. The factors mentioned above cause the local stress to rise above the endurance limit, and failure results in a relatively short time. Highly stressed springs, in particular, are sensitive to surface imperfections, and formerly springs were very carefully polished. Now, however, shot-peening is replacing this treatment with remarkable results.

It has been generally accepted that parts whose surfaces are in a state of residual tensile stress have a lower fatigue strength than those which are unstressed, and that when these surfaces are in a state of residual compressive stress the fatigue strength is raised to a very marked degree.

Surface tensile stresses are introduced by many factors. The heat which is created by machine polishing, milling, turning, or grinding is often sufficient to leave the surface in a condition of tensional stress. The surface of a gear tooth which has been improperly ground is often left in a state of tensional stress. Fatigue cracks will form on the side of the tooth loaded in tension since this stress is added to the residual stress. Soon the tooth will weaken and the gear fail, not because of poor design, but by failure to consider what may happen to the gear during the time it ceased to be " a blueprint " and became an integral part of a moving mass of machinery.

There are, of course, many excellent ways of introducing surface compressive stress or converting existing surface tensile stresses to compressive stresses. The most widely used method is that of shot-peening[2], which consists of peppering the surface of the part with hundreds of small shot which " cold works " the metal. Only a thin layer near the surface is affected and it is left in a state of compressive stress. Crankshafts, connecting rods, springs, gears, axle shafts, and many more parts too numerous to mention have had their fatigue life extended by shot-peening. Shot-peening often eliminates grinding and polishing. It also serves to smooth out surface imperfections, etc., and thus offsets the stress concentrations due to those causes. More and more applications are being found for this treatment, and designing engineers and research labor-

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[1]Endurance limit is the highest stress which will not cause failure no matter how often repeated.

[2]Other methods are: cold rolling, cold drawing, nitriding, and other types of case hardening.

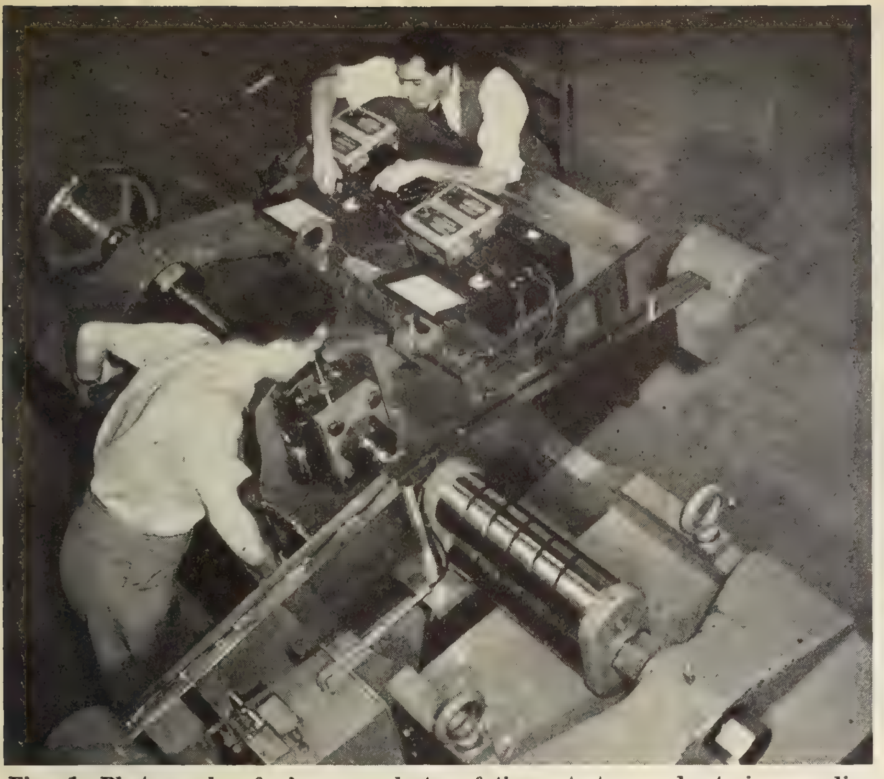

Fig. 1—Photograph of Avery pulsator fatigue tester and strain-recording instruments used at the Bureau of Mines' physical metallurgy research laboratories, Ottawa. Capacity, up to 20 tons.

atories are thoroughly investigating its possibilities.

It may be seen that fatigue life may be decreased or increased, depending upon the treatment a part receives during the production cycle. Obviously, it is a duty of the metallurgist and designer to assure themselves that life-destroying features are not introduced by the production department and furthermore, to introduce wherever possible life-extending features as the case demands.

There is, unfortunately, too little correlation between the fatigue strength of a material as determined by the conventional fatigue specimens, and machine parts made from this material. A fatigue machine nowhere duplicated on this continent has been installed at the Physical Metallurgy Research Laboratories in the Bureau of Mines at Ottawa (Fig. 1). This machine is capable of determining the fatigue life of large machine parts as well as of conventional fatigue specimens. Thus, it is hoped to establish a better correlation between the two. Another type of machine of similar capacity will be installed.

It has been proved in actual field trials that stress concentrations (such as occur as a result of surface imperfections), peculiarities of contour, thermal treatments, etc., greatly affect performance, a fact often overlooked by part designers. It is possible, by employing large fatigue machines such as that shown in Fig. 1, to shorten the testing time from a matter of weeks to a few days. Large crankshafts, axles, connecting rods, etc., can be accommodated in these machines. Thus, by varying certain design features, or surface finish, etc., the effect of these on service life can be learned in a short time.

Internal Stress

It has been pointed out above that internal stress can be beneficial or detrimental. In most metal components, internal stresses are undesirable, although sometimes they are intentionally produced in order to counterbalance stresses of opposite sign which are produced in service, e.g. in gun tubes (autofrettage). In parts subjected to repeated stresses, internal stress can combine with the applied stress to either increase or decrease the actual maximum stress.

If a part contained internal stress of the same sign as those produced in service, early failure could occur. Obviously, then, designing and metallurgical engineers must be foresighted enough to plan the various operations which will be performed on the part while it is still on the drawing board, in order to prevent, if possible, creation of stresses which will not be of benefit in the function of the part. There are so many factors which are capable of producing internal stress from the time the part begins to take shape, either by casting, forging or machining, until it is placed in service, that each operation must be carefully considered as to its effect on the final shape and service of the part.

In general, internal stress may be produced by temperature changes, allotropic volume changes, and working of the metal.

Proper pouring temperatures, mould conditions, etc., will help to produce a good casting. However, optimum pouring and cooling conditions will not produce a good casting if the original design had poorly proportioned sections, sharp corners, etc., which cause unequal cooling and result in high internal stresses, shrinkages, and so on.

A tool or part made from deep-hardening alloy steel and hardened, undergoes extensive volume changes during this process. These changes often result in high internal stresses being set up, which sometimes are relieved by tempering and at other times are unrelieved because the high hardness is required. In order to minimize these stresses, the designer must proportion the sections so as to obtain as equal a cooling rate as possible. Sharp corners, inadequate fillets, etc.,

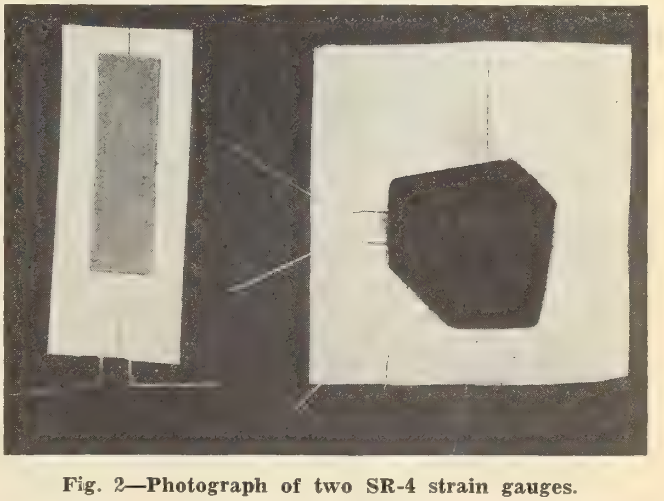

Fig. 2—Photograph of two SR-4 strain gauges.

Fig. 3—Testing a Belleville spring at the Bureau of Mines' physical metallurgy research laboratories, using SR-4 strain gauges and strain indicator.

must be absent, because these represent points of high stress concentration. Furthermore, the heat treatment specified and the material selected are important since they, too, determine the extent of the internal stresses. Design, heat treatment, machining, etc., go hand in hand, and as such are a responsibility to be shared by the design, metallurgical, and production departments.

Ignorance as to the magnitude and distribution of internal stress has been dissipated to a considerable extent by the use of new techniques for measuring these stresses. Among the methods currently used are photo-elasticity, X-ray diffraction, strain gauges, and brittle lacquers. These techniques are briefly described later in this article.

It is seen that internal stresses, when they are of an unfavourable kind, can result in lowered tensile and yield strength, and lowered fatigue life. They may also cause stress (" season ") cracking, quench cracking, and grinding cracks. Warping during machining also results from internal stresses.

Selection of Material

One of the first problems the designing engineer encounters is that of the material he is to use in his design. Many machine parts or structures have failed, not because of bad design, but because too little attention was paid to the kind of material selected and its subsequent processing.

A few of the more important considerations which the designer and metallurgist must observe in selecting material are as follows:

(1) The climate in which a machine or a structure is to operate is an important consideration in the selection of a metal. It is not too well known among engineers that certain steels and zinc base alloys have very poor impact properties at low temperatures. Obviously they would be unsuited to withstand rough operation in climates such as northern Canada or Russia. Similarly, certain metals undergo " creep " when under stress at high temperatures. An understanding of this phenomenon is particularly important in power boiler design.

(2) In selecting a material from which a component is to be made, the engineer must decide upon the heat treatment to be given to it. Far too often this is either overlooked or becomes a routine affair, when in reality the greatest significance should be attached to it. Steel, for example, can be normalized, quenched and drawn, austempered, martempered, etc., to give exactly the same tensile strengths, but many of its other properties such as yield, impact and fatigue strengths will be widely different. Improvement in heat treatment technique when properly applied can result in lower manufacturing costs and a better, more uniform product.

(3) The design of welded structures involves many problems besides selection of the proper material. The flux and welding rod to be used, welding technique, preheat temperature, jigging, cooling rate, heat treatment, etc., all influence the strength of the base metal and of the weld itself. The welds must be clean, sound, tough, as free from high internal stresses as possible, and be properly shaped to have good fatigue properties if subjected to repeated stresses.

(4) Many parts are subjected to corrosive liquids, gases, etc. Under this action, metals weaken and eventually fail, particularly if subjected to repeated stresses. Some metals are, however, more resistant to corrosive action than others. Those that are attacked can be protected. Corrosion is a broad field and the designer should seek adequate information when designing components which are subject to corrosive action.

(5) Certain materials have decided advantages over others for particular applications. For example, in the manufacture of springs certain steels have a decided tendency to decarburize during heat treatment. Since a decarburized surface is detrimental to the life of a spring, such a feature must be recognized in the original specification.

Fig. 4—Dynamic strain recorder used at the Bureau of Mines' physical metallurgy research laboratories.

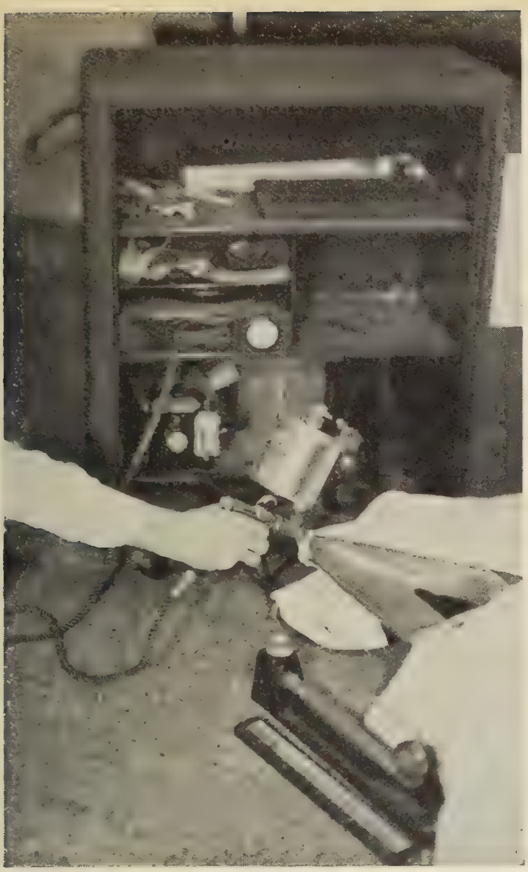

Fig. 5—Angle bracket being sprayed with stress-coat.

(6) Grain size of materials such as steel and aluminium is particularly important in certain parts. For example, steel with large grain size has lower impact strength, particularly at low temperatures.

The above factors are only a few of the many involved. Not just " any old thing " will do, but careful thought must be given to the choice of the metal from which machines are constructed.

Experimental Determination of Stress Distribution

As mentioned above, strain gauges, brittle lacquers, photo-elasticity, and X-ray diffraction are techniques used to ascertain the distribution and magnitude of stress in bodies which either contain locked-up stresses or are subjected to external loads which cause stresses. These convenient and practical engineering tools are of very great value in producing designs, which formerly involved considerable guesswork. With the information obtained, engineers can accurately strengthen highly stressed parts or reduce safely the weight of lightly stressed parts.

Strain Gauges

The SR-4 electrical strain gauge, which is the most widely used of the gauges of this type, was perfected in its present state by Prof. A. V. DeForest and A. C. Ruge of Massachusetts Institute of Technology. This gauge makes it possible to measure the stresses in a part or structure with an accuracy never attained before. These stresses may be caused by static, impact, or repeated loading and the gauges are used with equal facility for all conditions.

Figure 2 shows such gauges. The gauges consist of a fine resistance-wire supported on paper or plastic and then cemented firmly to the spot where the strains are to be measured. The gauge adheres so firmly to the metal that as the metal is strained the wire follows the movement linearly. Thus, if the metal is strained in either tension or compression, the cross-section of the resistance-wire is changed and the resistance changes correspondingly. These changes in resistance are recorded by a special type of Wheatstone bridge, as shown in Fig. 3. This Wheatstone bridge can be used only for static or slowly applied loads. For impact loads or rapidly moving parts, amplifying and oscillograph equipment is required. A photograph of this equipment is shown in Fig. 4.

The usual procedure is to cement gauges to the part being studied and load it statically to duplicate service conditions, or actually put the part in service and measure the stresses with dynamic recording equipment. This latter method is being used extensively in the aircraft industry. The gauges are placed on all stressed structures (wings, fuselage, etc.) and the stresses recorded while the plane is in flight. The information thus obtained enables the designers to make the necessary corrections in design.

Crankshafts, connecting rods, bridges, cranes, hoists and springs are a few of the structures studied by this method. Figure 3 is a new design of Belleville spring which was studied in the Bureau of Mines' Physical Metallurgy Research Laboratories, at Ottawa. Gauges were cemented both in the tangential and radial direction on the top and bottom of the spring. The stress distribution was ascertained while the spring was subjected to various loads.

These gauges have also been used at the Bureau of Mines' Physical Metallurgy Research Laboratories to measure residual stresses such as those caused by quenching, improper drawing, or annealing; stresses caused by cold drawing of bar and tubing; stresses in welded structures; and so on. It is evident, then, that

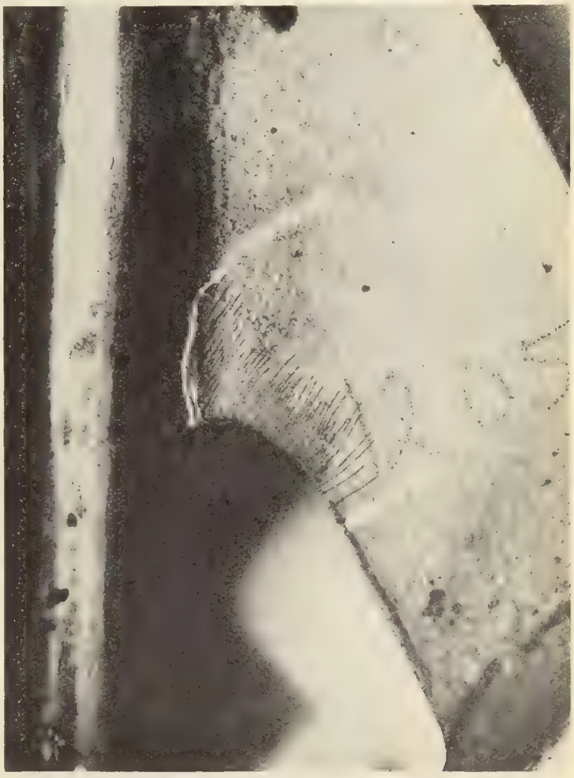

Fig. 6—Angle bracket after loading. Note cracks in lacquer. Direction of stress is at right angles to cracks.

this gauge is materially assisting metallurgical and designing engineers in their efforts to improve old designs or develop new ones.

Brittle Lacquers

Brittle lacquers, commonly sold under the trade name of Stresscoat, are used in ascertaining the overall distribution of stress in any structure. The method consists of spraying the part or assembly with a coating of brittle lacquer. When the part or assembly is loaded, the points of maximum strain are indicated by the local cracking of the lacquer. Since the lacquers are made to give varying degrees of strain sensitivity, fairly good quantitative measurement of strain is possible by selecting the proper lacquer. A calibration strip, coated with the same lacquer, determines the strain sensitivity of the lacquer.

Brittle lacquers thus present an over-all picture of the distribution of stress in any body. The part used need not be the actual structure, but may be a cast model. By determining the location and approximate magnitude of the stresses, which incidentally are at right angles to the cracks, more accurate determination of stress with electrical strain gauges may then be made at the critical areas indicated by the lacquer. Figure 5 is a photograph of the equipment for conducting tests using this technique. The photograph shows a bracket which was sprayed with Stresscoat at the Bureau of Mines' Physical Metallurgy Research Laboratories. After drying, the bracket was loaded incrementally and watched to determine the manner and the positions in which the cracks formed. Figure 6 is a photograph of the bracket, showing the cracks formed in the lacquer.

Stresscoat represents the fastest method now available for obtaining a complete stress pattern of a loaded part. It is somewhat difficult to obtain quantitative results, but if used in conjunction with strain gauges both qualitative and accurate quantitative results can be obtained.

Photo-Elasticity

By constructing a scale model of a newly-designed part, in some suitable transparent material such as celluloid, and examining it under load by polarized light, the regions of high stresses are clearly outlined. The determination of stress concentrations is facilitated by the use of photo-elastic models of parts where stress concentrations are suspected. Thus nuclei for possible fatigue failures can be discovered and the design altered to remove them.

X-Ray Diffraction

This technique has been used of late to measure stresses in metal. By measuring the distance between atomic planes in metal aggregates oriented at different angles, under certain circumstances it is possible to determine the stresses at the surface. In unstressed metal a particular interatomic spacing will be obtained for all orientations. If, however, the metal is in a stressed condition this condition will no longer exist.

This is a non-destructive method of measuring residual stresses and has applications which no other method can offer.

There are many more instruments and machines available to the designing engineer in his search for the optimum design of a structure. Among them are radiographic equipment, the stroboscope, mechanical testing machines, vibration testing machines, and so on. It is notable that, in the field of mechanical testing, the trend is toward testing dynamically rather than statically. All of these instruments and machines are finding increasing use with designing and metallurgical engineers.

If the designer would seek information from the metallurgist as to the proper specification of a material and the metallurgist would seek precise data from the designer on the service requirements to which the material would be subjected, many design problems would reach a more satisfactory conclusion.

RADIO FOR OVER-LAND LONG-DISTANCE TELEPHONE SERVICE

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Paper presented before a joint meeting of the Toronto Branch of The Engineering Institute of Canada and the Toronto Section of the Institute of Radio Engineers, on November 30th, 1944.

SUMMARY—In recent years, development of ultra-high-frequency radio technique and apparatus has progressed at such a rapid rate that the use of radio instead of wire lines for commercial telephony for long distances over land areas is an immediate practical possibility. This paper discusses in a descriptive way the recent technical advances and their application to over-land telephony. As a typical example, an outline is given of a radio system that would provide telephone service between Ottawa and Halifax.

Introduction

Engineering papers can be divided into two classes: those which are descriptive of that which has been accomplished, and those which make proposals for what should be done. The first class are exact in nature, and can be properly termed scientific, since they deal with problems which have been investigated and solved, with works which have been constructed and whose performance has been measured, or with researches which have been undertaken and whose results are known precisely. The engineer is fortunate who delivers a paper of this sort. Neither his conclusions nor his motives are open to question, since his only aim is to enlighten his fellow engineers by adding his knowledge to theirs. The subject of the present paper is to make a new proposal. It has been stated that the world cannot progress without imagination, and the following paragraphs paint a possibly somewhat imaginative picture of what could be accomplished by the application of some of the engineering ideas now current to a practical and pressing Canadian problem.

The theoretical and practical development of radio has now advanced to the point where the generation-old idea that ordinary telephone and telegraph communication could be carried by radio waves instead of by copper wires strung on wooden poles, has become an immediate practical possibility. Wire communication has a long and honourable history. Morse in America, and Wheatstone in England, were operating commercial telegraph systems more than one hundred years ago. The telephone was in commercial use nearly seventy years ago. Fifty years ago, radio transmission was demonstrated in practical form. Thirty years ago, radio telephony in a practical form was demonstrated. It is twenty years since radio has been a familiar accessory in almost every home, and yet the fact remains that in over-land telephony and telegraphy, an industry which overshadows by a huge amount any of the other uses of radio, we still employ almost exclusively wire-line techniques. Radio is used for trans-oceanic communication both by telephone and telegraph, for transmission to and from airplanes, and has played a very large part in all phases of military operations in this war. It is used for broadcasting, and in some rather specialized and not very extensive applications — in point-to-point transmission, and police and other mobile services, for example — but it is not yet used for the great bulk of telephone and telegraph communications.

An outline of the technical and economic possibilities of doing this in the light of present knowledge and engineering technique follows. It is not proposed to discuss the specialized transmission and modulation techniques which have been evolved during the war, even if we were free to do so. The subject is large enough without the necessity of speculating on the added help some of these new ideas might be to us. It might be mentioned that any figures or data given are derived from sources which are generally available.

For A Canadian Personality

In any subject involving Canada, it should be realized that engineers must take into account the peculiar nature of the Canadian terrain, climate, geography, and distribution of population. Engineers are likely to be internationalists, and to assume that what is done in the United States, or Great Britain, or Russia, or Germany, is of general application to our conditions. Canadians are somewhat forced into this view because of the relatively small amount of technical research done in this country. We are told that, per capita, Canada spends on research only about 1/3 as much as Great Britain, 1/6 as much as the United States, and 1/8 as much as the U.S.S.R. This means that nearly all our technical ideas come from abroad, and the natural inclination is to seize on them and to assume, for example, that American technique applies to Canadian conditions in the same way as it applies to American conditions. This is just not so. In Canada we should not be building houses of the same design, or with the same materials as are used, for example, in England. We should have different kinds of heating systems, different kinds of windows, and different kinds of roofs than are used, say, in the United States. We should wear different kinds of clothing than are worn in European cities. We require different kinds of radio sets in Canada than are required in the United States. Canada is a country with about the area of the United States, but one-tenth as many broadcasting stations, so that we have to contend with a quite different set of transmission problems. The influence of the two great nations on each side of us is to bring us into conformity with their habits and prejudices, even in remarkably small points. Progressive-minded engineers who wish to improve the Canadian economy must forever keep in mind that Canadian conditions require special thinking.

To build a house at latitude 60 deg. N. of the same design, and with the same materials intended for use at latitude 40 deg. N. is ill-advised, yet most of us have seen this done. At latitude 60 deg. N. with temperatures for long periods of the year down to the freezing point of mercury, there is likely to be 8 or 10 ft. of snow on the roof. Materials are not readily obtained locally, and are not easily worked by the local labour. The auxiliary purposes for which a house is used are likely to be widely different in the two localities because the trades practised are generally quite different. This is the kind of error into which Canadian engineering—engineering is meant in its

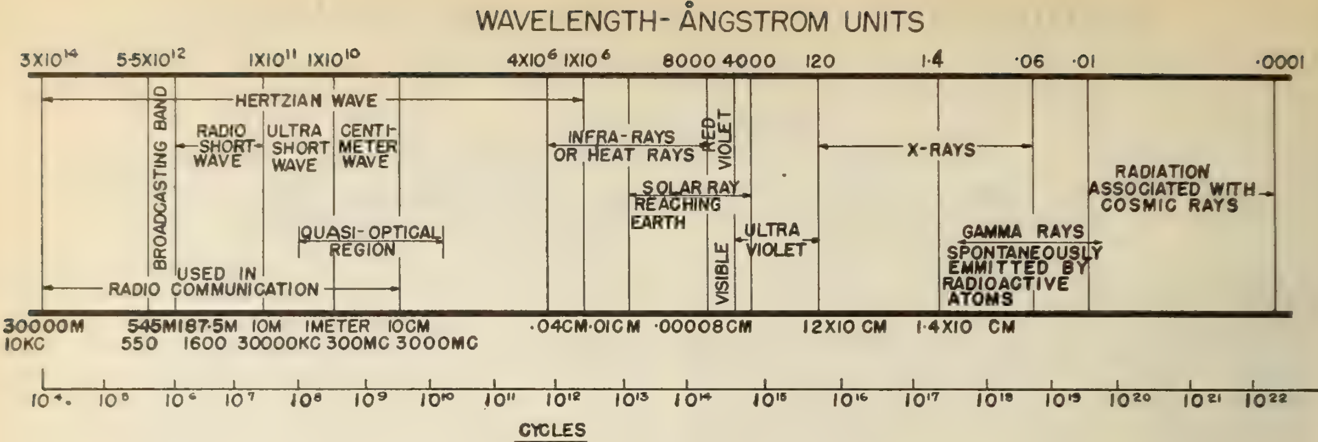

Fig. 1—The electromagnetic spectrum.

broadest sense—is continually likely to fall. In some cases we cannot help ourselves—in many, however, we can.

The Canadian Communication Problem

A study of the distribution of population in Canada, gives an idea of the staggering transportation and communication problem which we face. The population of Canada is stretched out in a long ribbon, which is hardly anywhere more than 300 or 400 miles wide, and in most cases, much narrower. North of the Great Lakes the ribbon almost ceases. The ribbon is over 4,000 miles long. If we make a very rough approximation and say that the inhabited part of Canada is 250 miles wide by 4,000 miles long, we come to an area of 1,000,000 square miles, and this represents a square 1,000 miles to a side. If Canada were contained in such a square, then ignoring the empty areas of the country, and considering only the inhabited portions, the whole of the population could be contained at its present density in the area of the provinces of Saskatchewan and Manitoba, and our communication and transportation problems would be a small fraction of what they are now.

It becomes apparent that communication systems designed for use in densely inhabited areas, such as Europe and the United States, are far from suitable for Canada. Some additional factors are also apparent. The per capita income of Canada is very much lower than that of the United States, and in addition weather conditions are very much more severe in Canada. In the east we have heavy snow fall and bad icing; in the centre and west we have very low temperatures; and in the far east and far west we have high velocity gales combined with any, or all, of the other hazards. Such rigorous climatic conditions as prevail generally in Canada make outside construction of any kind both more difficult and more subject to outage than in the United States.

It is apparent that, of all the nations on earth, this country is more in need than most of low-cost communication, not unduly subject to attack by the weather. The very life blood of Canada is its transportation and communication facilities. The channels of trade have to be kept open along a long narrow ribbon, and low-cost, efficient communication, specifically adapted for our needs, can do more in the author's opinion to enhance the economic and industrial efficiency of this country than any other single factor. Geographically, Canada is an anomaly. We trade, and strive for national unity in a direction which is contrary to geography and every natural barrier. Starting under this initial handicap, it is apparent that special methods must be devised to permit us to operate with the same community of interest and national unity which other countries achieve by geography.

The Solution: Radio-Telephony

The question then comes up—what can radio do for communication in this country which wire lines cannot, or do not do? To get the correct answer, it is necessary to examine some of the technical points in a certain amount of detail, and it will be apparent that the conclusions arrived at, while applying to Canada in a very strong degree, are applicable to other countries also, perhaps with less force but nevertheless with sufficient force to be of serious interest.

Radio Waves and Their Way of Propagation

The first question we must answer is what kind of radio waves we are talking about. Figure 1 shows the spectrum of electromagnetic waves. This chart, which is one of the simplest and most useful presentations which physics offers, shows the scale of electromagnetic radiation between the frequencies of 10^4 cycles and 10^{22} cycles per second. Below this band of frequencies exist the non-radiated electric waves used in speech and power transmission. It has been remarked by a layman that the communication engineer appears to know only one word—" frequency " —since this occurs so often in his conversation. This is rather an illuminating remark because the fact is that all the phenomena with which communication engineers work centre around the frequency at which the phenomena take place. To talk about radio engineering problems without first specifying frequency is like discussing a horse without mentioning its age.

The frequencies used in ordinary radio transmission extend, from say 30 kilocycles to 30 megacycles. Above this band lies what is ordinarily referred to as the ultra-high-frequency spectrum. This begins at around 30 megacycles, and we have reason to believe that, at the present time, it extends usefully to around 30,000 megacycles, or a wave length of one centimetre. Above the ultra-high-frequency spectrum, as the frequency increases we have electromagnetic radiation which manifests itself first as heat, then as light, and so on through X-rays up to the highest-frequency waves known, which for want of a better name have been called cosmic rays.

The waves in the radio spectrum itself show a very marked change in properties as the frequency changes. Aside from the secondary questions of circuits, component apparatus, and antennas, we are primarily concerned with the way in which the propagation of these waves changes with frequency. There are four different ways in which a wave radiated from a transmitting antenna may reach the receiving antenna. These are shown in Figure 2. One path is along the surface of the ground, partly within the ground itself, and partly in the air layer immediately above the ground. A wave which is thus guided by the ground surface is the most important mode of transmission of the low-frequency end of the radio spectrum up to, say, 1.5 or 2 megacycles. A second way in which the energy can reach the receiver is in the case where the wave is propagated upwards from the transmitting antenna, and is reflected from one or more of the ionized layers existing in the rarified regions of the atmosphere from 30 to 200 miles above the earth's surface; such a path is shown in Figure 3. These layers, known as the Heaviside or Kennelly layers, reflect the wave to earth again. Any wave may undergo several such reflections, and this mode of propagation is that chiefly occurring for waves between about 2 megacycles and about 30 megacycles. Above 30 megacycles the reflected wave becomes of little importance, and the energy is received chiefly from two paths, one a direct path between the transmitting and receiving antenna, and the other the path due to reflection by the ground between the two antennas.

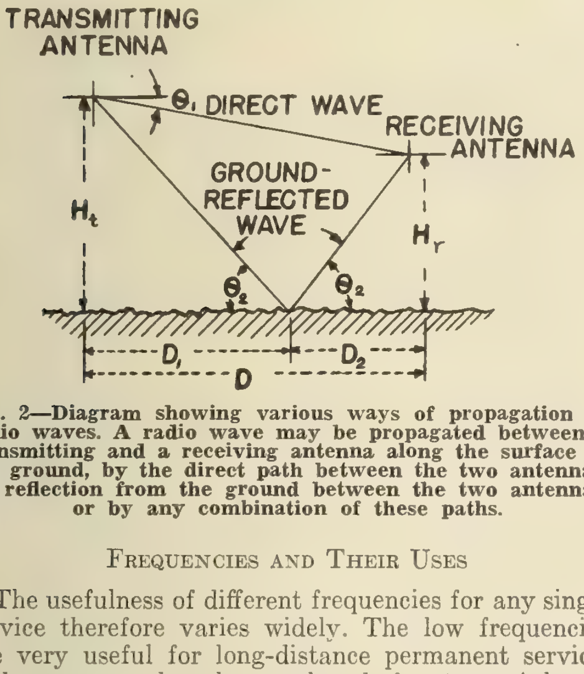

Fig. 2—Diagram showing various ways of propagation of radio waves. A radio wave may be propagated between a transmitting and a receiving antenna along the surface of the ground, by the direct path between the two antennas, by reflection from the ground between the two antennas, or by any combination of these paths.

Frequencies and Their Uses

The usefulness of different frequencies for any single service therefore varies widely. The low frequencies are very useful for long-distance permanent service, and are very largely employed for trans-Atlantic communication, for aerial navigation systems, and similar purposes. They suffer somewhat from auroral storms, but provide stable communication, although this is achieved at a very high cost. Very large amounts of power must be used in order to overcome the natural noise level existing at these frequencies, and very large antennas must be employed to radiate this power with any degree of efficiency.

Although the chart of the frequency spectrum indicates equal band-widths for equal frequency ratios, this is not quite how the problem works out in practice. The chart is based on a logarithmic scale, but in actual transmission systems we are concerned not only with a logarithmic base for frequency, but we also have to consider the problem of how many cycles are available in any band. For this reason, the number of channels available for transmission at the low frequencies is very much restricted, and this point, together with the high power necessary, the large antennas required, the difficulty of achieving directional effects, and the complete lack of secrecy since the waves are transmitted to very long distances, makes this band of frequencies quite unsuitable for the purpose we have in mind.

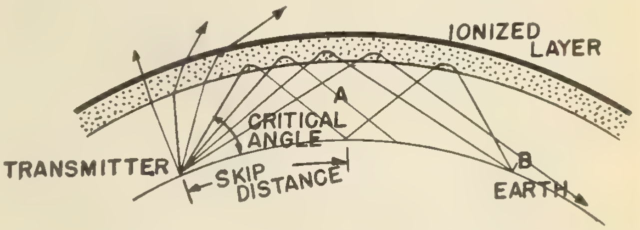

Fig. 3—Diagram illustrating propagation of radio waves by reflection from the ionized layers of the atmosphere. At frequencies lying between about 1.5 megacycles and 30 megacycles an additional path of propagation of a radio wave is by reflection from the ionized conducting layers of the atmosphere lying at heights from 30 to 200 miles above the earth's surface.

The middle band of frequencies, from 550 kilocycles to 1550 kilocycles is employed for local and regional broadcasting, and consideration of Fig. 4 shows why this is so. In the lower end of the broadcast, wave transmission is almost entirely by the ground. At the very upper limit some sky-wave transmission occurs in the day-time, although over the whole band there is sky-wave transmission at night. We therefore have the condition that ground attenuation, which is quite high for these frequencies, restricts the range of a station rather sharply in the day, and at night the range is even more restricted by interference between the ground wave and the sky wave. As soon as a point in the field of a station is reached where the sky wave becomes an appreciable part of the ground wave, then fading results, since the phase angle of the sky wave is continually changing and cancels out to a greater or lesser degree the ground wave.

At the lower frequency end of the broadcast band, excellent transmission is obtained to fairly long distances if the ground conductivity is high, and we have a situation in western Canada, for example, where a 50 kw. transmitter near the lower end of the band is heard in the day time for distances of close to 1,000 miles. Where ground conductivity is poor, however, this is not true and again we have the illustration of a 50 kw. broadcast transmitter located in the Maritimes where satisfactory transmission above 100 miles is not obtained. In the upper end of the broadcast band, ground attenuation is always high, and these frequencies are suitable only for local service, either night or day.

Above the broadcast band, say between 2 and 30 megacycles, lies a band of frequencies largely employed for commercial communication, such as aircraft and aircraft ground stations, ships, trans-oceanic telephones, etc. These waves are characterized by being transmitted almost entirely by one or more reflections from the Heaviside layers. It is to be seen from Fig. 4 that, for any distance, a particular frequency must be chosen and that this frequency must be changed for day or night service, summer or winter, and for the year, so that continual skilful care is needed to keep transmission reliable and satisfactory. Certain diffi-

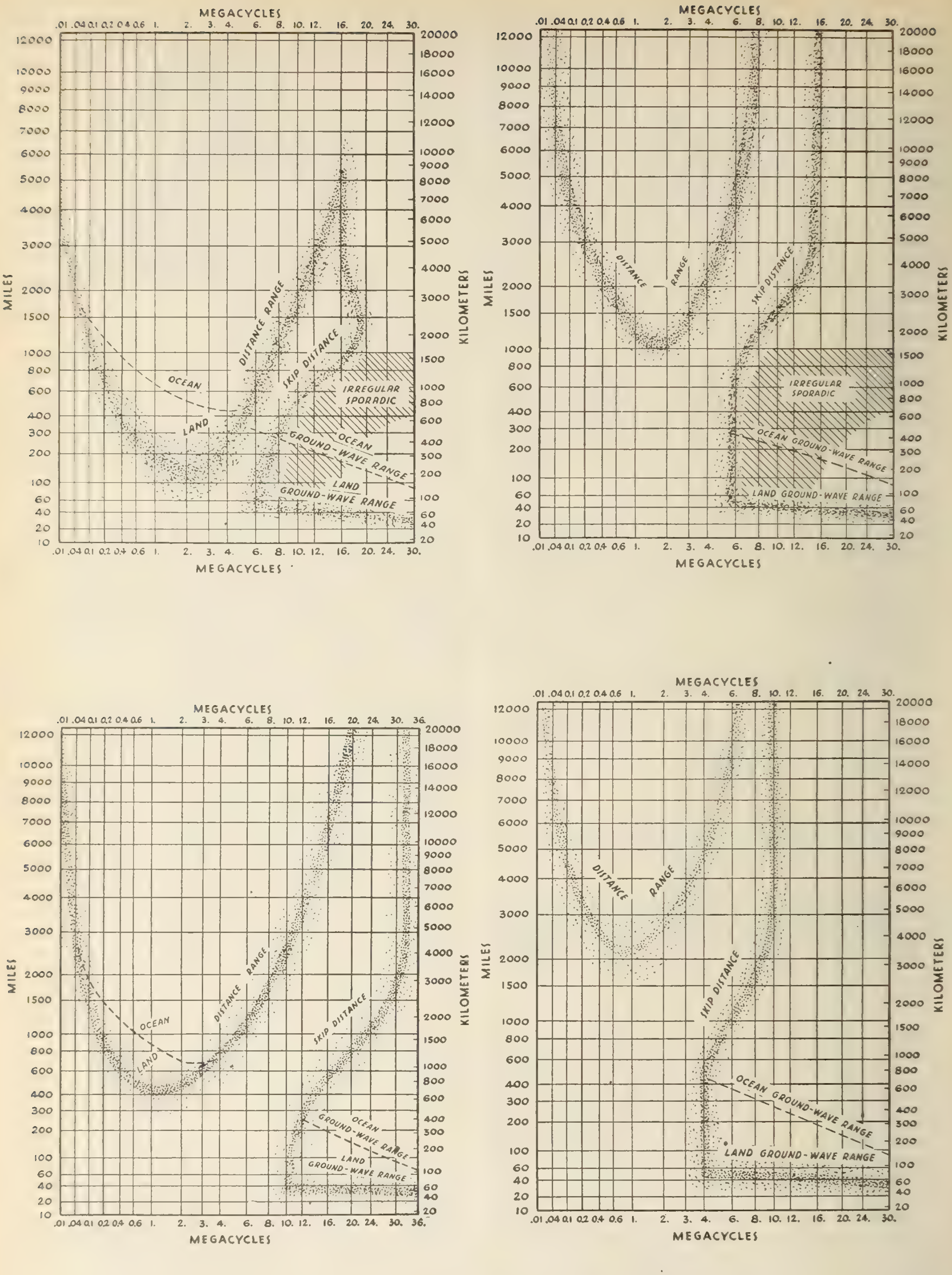

Fig. 4—These charts, prepared from information published by the Bureau of Standards, show the limits of distance over which practical radio communication is possible, and assume a received signal strength varying from 100 microvolts per meter at 0.1 megacycle down to 1 microvolt per meter at 10 megacycles. These charts are for the year 1941, and are accurate for the temperate zone. For noise-free radio telephone reception the distances should be decreased by a factor of about 5 to 1. These charts are based on 1 kw. radiated power.

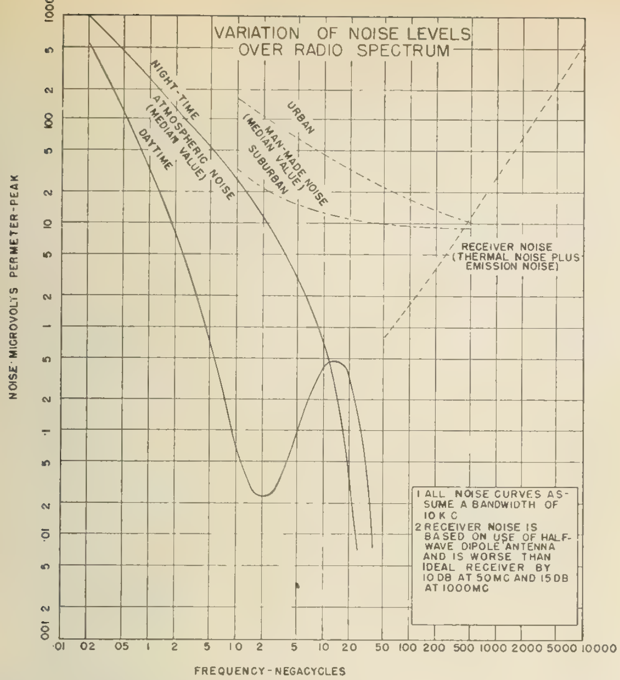

Fig. 5—Chart showing the variation of noise levels over the radio spectrum. Since the signal-to-noise ratio in any transmission system is most important, accurate knowledge of the noise existing over the radio frequency spectrum is of prime importance. The man-made noise curves shown are somewhat conservative, and in carefully chosen sites with the use of directional antennas and elimination of nearby noise sources, noise conditions could be obtained 10 times better than those shown.

culties are encountered transmitting across the sunset and sunrise lines, and taken all in all, this band of frequencies is suitable only for service where long-distance transmission is required, and skilful operation must be available to provide reliability over a large fraction of the time. Continuous reliability is not available on any basis in this band.

From 30 megacycles up, radio transmission becomes almost like transmission of light. The similarity becomes greater the higher we go in frequency, until above 100 megacycles the similarity is very striking indeed. The band below 100 megacycles contains various services at the present time. Frequency-modulation broadcasting is here, police and other mobile systems, some television, etc. At the lower part of this band, from 30 to 100 megacycles, some sky-wave reflection is obtained, which causes fading at some distances, and causes freak transmission to great distances occasionally. Noise conditions improve as the frequency is increased and, due to the reduction in antenna size, directional systems are possible without undue cost. The power required for transmission at a certain signal-to-noise ratio steadily decreases as the frequency is increased, but at the same time refraction effects decrease so that, at the upper part of the band, transmission is sharply limited to line-of-sight paths.

Figure 5 shows noise conditions which are encountered over the spectrum. It must be realized that the limiting factor in any kind of electrical transmission system is noise. This is not immediately apparent, but is a basic principle which is generally true. The signal-to-noise ratio is the chief figure of merit for any transmission system, and a consideration of the noise levels in any path determines, in the final count, the usefulness of that path as a medium of communication. This figure shows that, at low frequencies, path noise is relatively high, but decreases rapidly with frequency, reaching a minimum somewhere between 10 and 100 megacycles. Man-made noise is shown for urban and suburban conditions, but values at least ten times lower than those shown can be obtained by careful selection of sites, location of antennas, use of directional antennas, etc., so that these curves could be drawn in at voltage values ten times lower. The receiver noise is at a low value, somewhere in the neighbourhood of 10 megacycles, and climbs rapidly as the frequency is increased. These curves are drawn for the present state of the art, and no doubt will be improved by a large degree through further development. It will be seen that, at the present time from a noise standpoint, frequencies between 100 megacycles and 500 megacycles are indicated as the best, and rather extensive trials which have been made indicate that this is so. Since noise is the most important single factor in reliable systems, particularly those which may have long telephone circuits connected to either terminal, then it is important to take advantage of every possibility of reducing noise, and the adoption of frequency modulation rather than amplitude modulation is of considerable importance.

Frequency modulation means that the intelligence is added to the transmitted wave by varying the frequency rather than the amplitude of the carrier wave. Frequency modulation improves the signal-to-noise ratio above that obtained with an amplitude- modulation system.

The difficulty encountered, when these frequencies lying above 100 megacycles are used, is that transmission is not readily obtained over the horizon. Figure

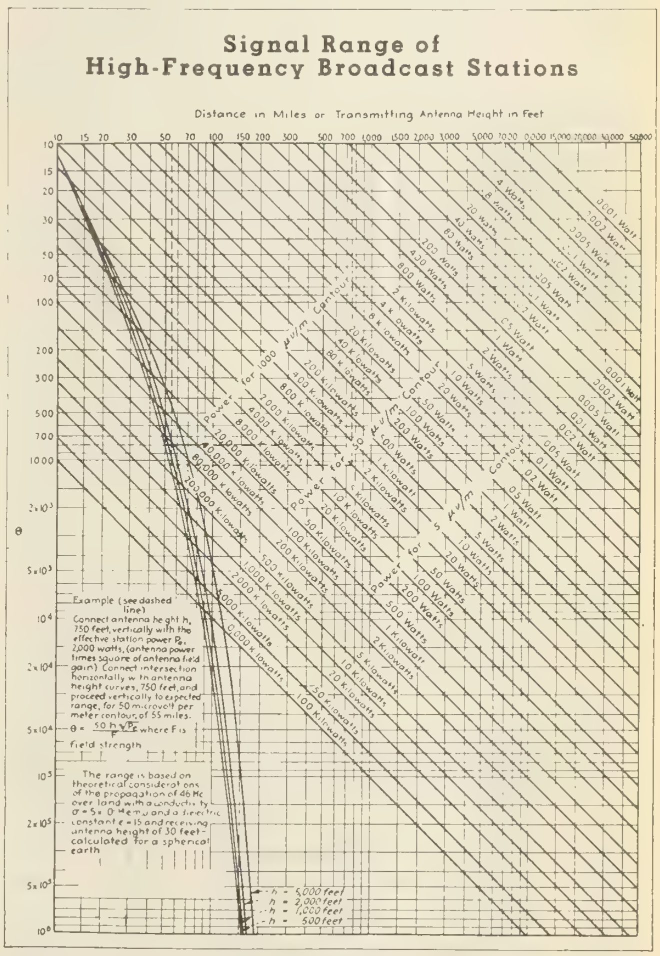

Fig. 6—Curves showing the signal range which may be expected of stations transmitting in the ultra-high-frequency band.

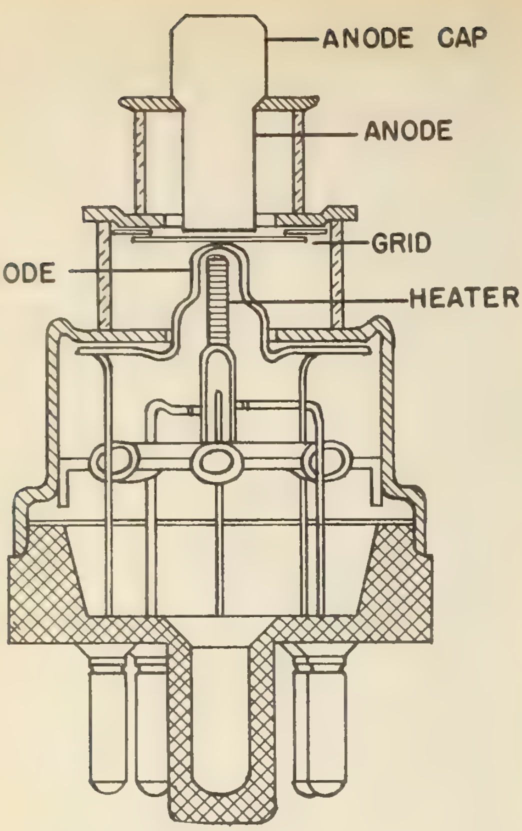

Fig. 7—Cross-sectional view of receiving type triode designed for operation at frequencies above 1000 megacycles.

6 shows the effect graphically. Although these curves were drawn up for a frequency of 46 megacycles, they apply rather accurately to the region around 100 megacycles also.

Theory of High-Frequency Transmission

Above 100 megacycles, the theory and practice of radio engineering differ markedly from the technique at more familiar frequencies. In this band, for example, lumped circuits disappear, and we must deal with circuit elements in which inductance, capacitance, and resistance are inextricably interwoven. The physical dimensions of circuit elements, including tubes, may be of the same order as that of the generated waves, so that these circuit elements can no longer be regarded as non-radiating, and it is necessary to think about fields rather than flow of current in conductors. The time of motion of the electrons in the tubes becomes a considerable fraction of a cycle, and may determine the upper frequency at which a tube operates.

One of the most fundamental concepts in electrical engineering is the flow of electrical current in a conductor. At low frequencies, the current distributes itself uniformly much as a direct current would. At higher frequencies the skin effect increases, and at frequencies of the order of 1000 megacycles the current does not penetrate more than a few thousands of an inch inside the conductor. The electrical current has therefore become a surface phenomenon in that it does not flow in the conductor, but on the conductor.

This has an important effect upon the radio engineer's thinking. Conductors have simply become boundaries within which the waves are propagated, and between which they exist. Instead of currents or charges or voltages he must think of electric and magnetic fields. In the usual picture he learned in school, electric and magnetic fields are sorts of branches which emanate from the currents and voltages which can be measured in the circuit, but when he considers the band lying in the neighborhood of 1000 megacycles, it is difficult to avoid the conclusion that he should consider no longer as fundamental the metal conductors, which now form only the boundaries for the phenomena; he now must think rather of the space which is enclosed by these conductors.

This begins to make electrical effects in this region much more like light waves, which we usually consider as passing through a medium, with the boundaries acting as generators, reflectors or absorbers, but boundaries only. We ordinarily think of light as a phenomenon taking place in a medium which will transmit light, not as something that takes place along mirrors or along other boundary surfaces. Something of what is meant can be seen from considering the most elementary of electrical circuits, a source of alternating current connected to a loop of wire. We have been taught that the current circulating in the loop sets up electric and magnetic fields. One way to look at this is that the current at every point in the wire gives rise to a changing magnetic field, and this in turn induces an electric current at every other point of the loop. The result is to require a certain amount of the applied voltage to be used in overcoming the field to permit current to flow. Clerk-Maxwell in his original analysis of electromagnetic phenomena drew the conclusion that electric and magnetic fields are not propagated instantaneously in the space surrounding the charges and current which cause them, but that these fields travel away from their sources with the velocity of light.

If the current source in the loop has a frequency of the order of 1000 megacycles, then for a loop of any possible dimensions an appreciable part of a cycle is required for the magnetic field to be set up by one part of the loop, travel to another part, and induce an electric field there. At ordinary frequencies, if this loop has no ohmic resistance, then it will consume no power because it will be a pure inductance with the phase of current and voltage at right angles. At 1000 megacycles, however, due to the short wave length, the induced electric field will be to some degree in phase with the current in the part of the wire in which this field is induced, so that power is

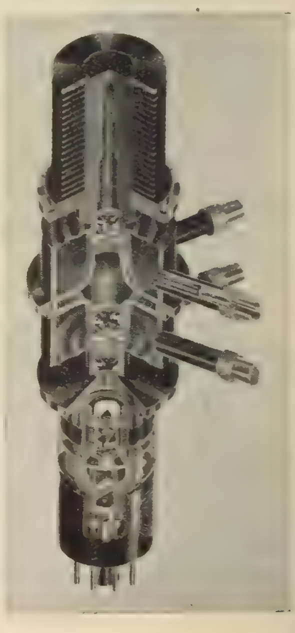

Fig. 8—The Klystron velocity-modulated oscillator shown here provides an efficient source of high-power oscillations at frequencies of the order of 3000 megacycles.

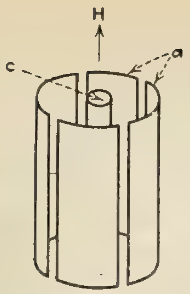

Fig. 9—The Magnetron is used as a power generator of frequencies at the extreme high end of the ultra-high-frequency band, and consists basically of a cylindrical cathode within a segmented cylindrical anode.

dissipated. This power must be radiated, and we have a condition where all circuit elements, however small, radiate energy freely. It is somewhat as though we were building a device for conducting heat in a complicated pattern through thermal conductors, such as copper rods; and in this case the surfaces of all the conductors would radiate heat continuously.

We have therefore arrived at a rather odd situation. At these frequencies, circuits in the usual sense hardly exist, because it is difficult to build anything small enough to be a circuit. Nevertheless, compared to a wave length, the circuits are large, and therefore the loss by radiation is also large. The communication engineer in other words is faced with a problem, really, of insulation.

Since these waves do not readily penetrate metal, the way to design circuits so that leakage of energy by radiation will not be excessive, is to build them so that the circuit is self-enclosed, and this gives rise to the resonant-cavity technique. Resonant cavities have an exact analogy to inductance-capacity circuit used at ordinary frequencies, and the exact way in which the equivalents are obtained need not detain us here.

At ordinary frequencies we can transmit power on a pair of parallel or twisted wires, or on a system composed of a rod concentric within a tube. As the frequency goes to the order of 1000 megacycles it is possible to dispense with the inner rod conductor, and employ simply a hollow tube. This effect occurs when the diameter of the tube is such that the waves will fit into it transversely. If we think of the wave guide, as it is now called, in a rectangular form, the picture becomes somewhat less puzzling. Two sides of the guide form the plates of a condenser, for example, between which the electric field is propagated. The other two sides are of such a length that they represent a high impedance connection between the two condenser plates, so that we have the phenomenon of electric wave energy being transmitted with high efficiency through a hollow pipe, and this despite the fact that it is difficult to detect any current flowing in the metal of the pipe itself.

A logical conclusion can be drawn that it should be possible to remove the pipe and still have the energy flowing through the core, and this is indeed possible, and has formed part of our modern ultra-high-frequency technique, where electric energy is now transmitted through a rod of solid dielectric metal, and neither an inner or an outer metallic conductor is employed. If it seems that this is an extraordinary way for electricity to behave, one should refer to the analogy of light being transmitted through a quartz rod; and this example is a much better introduction to electrical engineering at these frequencies than is the usual background of direct-current and low-frequency alternating-current phenomena.

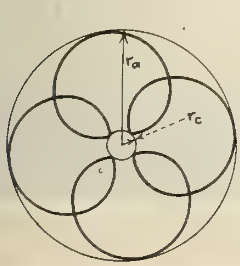

Fig. 10—In the Magnetron a high-frequency current is generated by the paths which the electrons emitted by the cathode follow under the influence of an axial magnetic field combined with a radial electric field.

The Thermionic Vacuum Tube

With these general remarks about this region, let us consider what is, here in a greater degree than in any other part of the spectrum, a basic device—the thermionic vacuum tube. There are three general types of modern ultra-high-frequency vacuum tubes. First, the triode, such as shown in Figure 7. This tube is rather a simple mechanical development from the ordinary filament-grid-plate vacuum tubes with which we are all familiar. Electrons are emitted by a disc cathode, pass through a disc grid ordinarily made of fine wire mesh, and are collected by the anode. The anode is made positive with respect to the cathode,

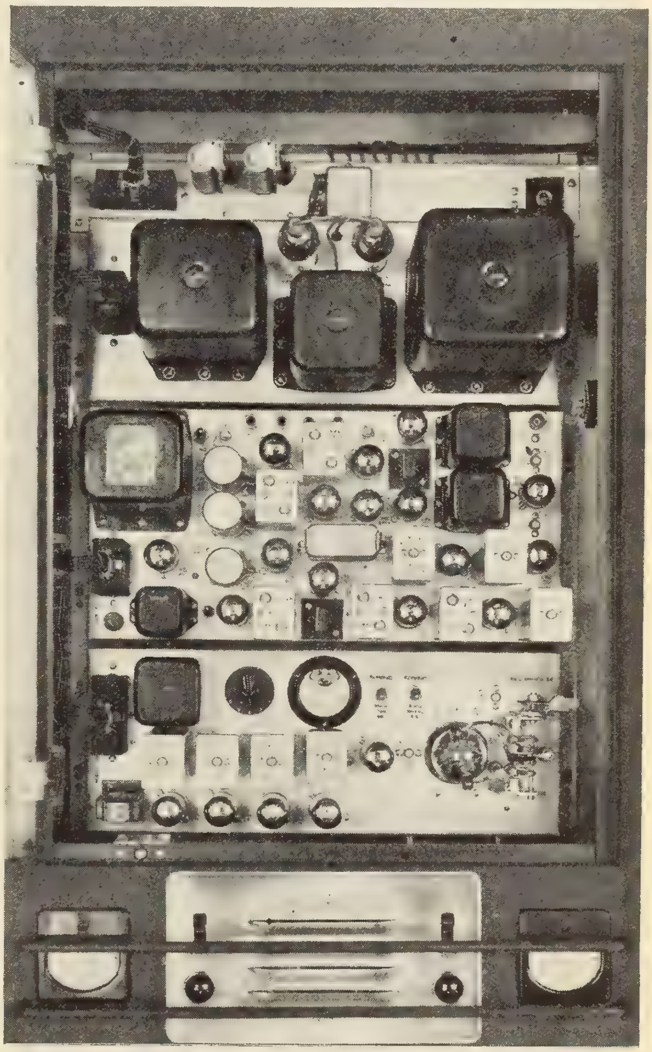

Fig. 11—Front view of 40 watt FM transmitter and receiver with auxiliary equipment intended for use at frequencies above 100 megacycles.

Fig. 12—The robust form in which directional antennas at high frequencies can be designed as exemplified by this 50 megacycle antenna. The total height is about 60 ft., and the construction is entirely of galvanized steel angle.

and the grid is ordinarily made negative so that the electrons, being negatively-charged particles emitted by the cathode, are drawn to the anode, and their flow is interrupted or regulated by variation of the negative voltage on the grid. As can be seen from this figure, the spacing between the elements has been made very small in order to reduce the time required for passage of the electrons, and tubes such as this operate up to frequencies of several hundred, or even several thousand megacycles in some applications.

The second class of tubes is the velocity-modulated type ordinarily known by the tradename " Klystron." Figure 8 shows one of these tubes. These tubes make use of the transit time instead of, as in the case of the triode, trying to reduce it. Electrons emitted by the cathode are alternately retarded and accelerated by the first group of grids they pass through, due to the alternating voltage between these grids and the cathode. When they pass through the second group of grids, the bunches of electrons induce an alternating field in the area enclosed by the grids and its associated resonant cavity, and part of this field is tapped off and fed back to the grids so that continous oscillations are sustained. The result is that we have an efficient generator of very high frequency waves, in which the transit time of the electrons has ceased to be a limitation.

The third method of producing oscillations at these frequencies is the magnetron. This is shown in Figures 9 and 10. Structurally, the magnetron consists of a cylindrical anode, and a concentric cathode. The anode is usually divided into several segments by means of longitudinal cuts. A direct-current potential is applied between anode and cathode, and a magnetic field is applied parallel to the electrode axis. The oscillatory circuits are attached between the anode segments. The theory of the operation of the magnetron is complex, and depends upon the path followed by the electrons emitted by the cathode under the influence of the crossed electric and magnetic fields. The electron on leaving the cathode describes approximately a circular path and returns to the centre of the tube, and for some values of magnetic and electric fields the electron just grazes the anode segment. The pattern of electron paths within the tube is therefore a four-leaf rosette, and the motion of the electrons produce a field whose wave length for practical values of magnetic field is very short, and waves of lengths as short as one centimetre can be generated at high efficiency.

To the engineer working in this field, the vacuum tube becomes more than just a valve that shuts on and off a current under the influence of a voltage applied to a control electrode. The current flow of a tube must be looked at rather as due to the motion of charges, and it is the integrated effect of all the induced currents due to all the charges which must be considered. The engineer working in these frequencies finds himself thinking about electron paths, electron velocity, transit time of electrons, and motion of space charges, rather than looking on the tube as a switch or a variable impedance.

Modern Ultra-High-Frequency Radio Equipment

It is of interest to consider some of the developments actually available today, of radio equipment in the band from 100 to 1000 megacycles. Figure 11 shows a 50-watt transmitter and receiver, with power supply and auxiliary equipment, which is available on the market today and operates between 100 and 200 megacycles. This unit employs frequency modulation with a swing of ± 50 kilocycles. It transmits an audio wave flat within 1 db. from 200 to 12,000 cycles. It is designed for continuous unattended operation, and demonstrates to what a thoroughly practical point the development of ultra-high-frequency equipment has been brought. A complete range of equipment units are available. Antennas, transmission lines, emergency power supply equipment, etc., have all been developed in complete, practical, and robust form.

An ever-present consideration in the use of these frequencies is that transmission can take place only on line-of-sight paths. This may appear to be a serious handicap at first glance, but a study of the geographical features of this country indicate that it is not serious. The routing of radio circuits should be thought about in somewhat the same terms as the routing of a railroad. Just as the railroad must seek essentially zero-slope paths, so must a ultra-high-frequency radio system seek essentially line-of-sight paths. When it is necessary for a railroad to cross a valley at right

Fig. 13—At frequencies of the order of 100 megacycles simplified directional antennas become possible, and the cost and amount of land required for a site are both reduced.

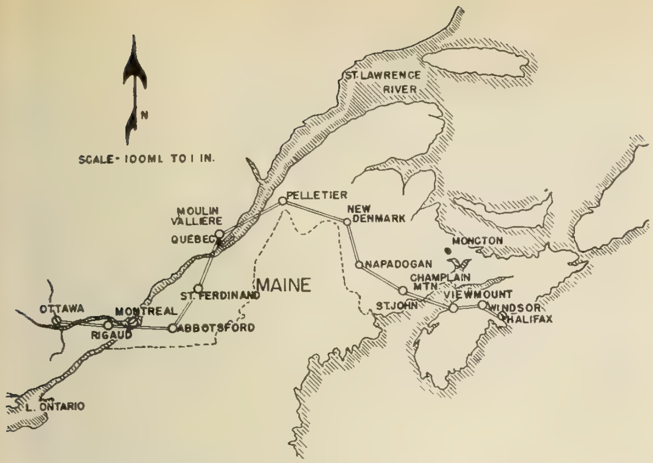

Fig. 14—Map showing a possible route for a radio network between Ottawa and Halifax.

angles, then a bridge is built. When a radio system must reach a point without sufficient elevation, then towers must be built. The parallel can be developed to considerable lengths.

In some terrain and under some climatic conditions it will, however, be undesirable to seek line-of-sight paths. This will be particularly true in mountainous country, and in country where roads, railroads, and habitations are very sparse, or lacking altogether. In this case we have an almost ideal solution in the frequency band below 100 megacycles where considerable refraction around moderate obstacles and the curvature of the earth is obtained. Certain forms of interference are experienced to a minor degree of frequencies between about 30 and 50 megacycles. This interference is due chiefly to reflection under certain conditions from the upper ionized layers of the atmosphere. From about 50 megacycles to about 100 megacycles such interference either does not exist or is negligible, and this band of frequencies provides great facility in choice of sites in country where hilltop locations are impractical.

Example of a Possible Radio Route

Figure 14 shows, the kind of radio route which could be suggested, using ultra-high-frequency unattended equipment. This would reach from Ottawa to Halifax, with 10 repeater stations, and would provide a circuit with signal-to-noise ratio, distortion, transmission variation, and outage due to weather, of extraordinarily good quality. It is interesting to note how readily a satisfactory route can be devised between two terminal points chosen at random.

It will be seen that the route follows practically the shortest path possible, and that the over-all route being about 800 miles, the average distance between repeaters is about 80 miles. This illustrative example was chosen at random, and was not suggested because the terrain was unusually favourable. Figure 15 shows the series of vertical contours between the repeater stations, and based on previous experience and some calculation, it has been determined that the transmission over this group of contours will be satisfactory in every way.

The antennas at all points would probably be the same, and would be chosen from among three types. The first type is a diamond-shaped antenna in a horizontal plane. There will be four antennas required at each repeater point, and these will be strung on twelve 30-ft. wooden poles. The antennas will be about 40 ft. to the side, and will consist of a single No. 6 copperweld conductor. Each antenna would be connected to the equipment house, which would normally be located in the centre of the group, by an open-wire transmission line. These antennas would have a gain of the order of 15 db. over a single dipole, and take advantage of the features of low cost, extreme ruggedness, simplicity of construction, high gain, and noncritical adjustment.

Several other antenna forms are simple, cheap, and effective. The most conventional of these is a series of half-wave radiating elements disposed so as to give the maximum gain in the direction required. Such structures can be built of steel angle and welded or riveted with no complications about accuracy of spacing, insulation, etc. A conventional form which such directional antennas have frequently assumed requires only a single insulator, and antennas of this sort could be designed for any frequency required. In the upper

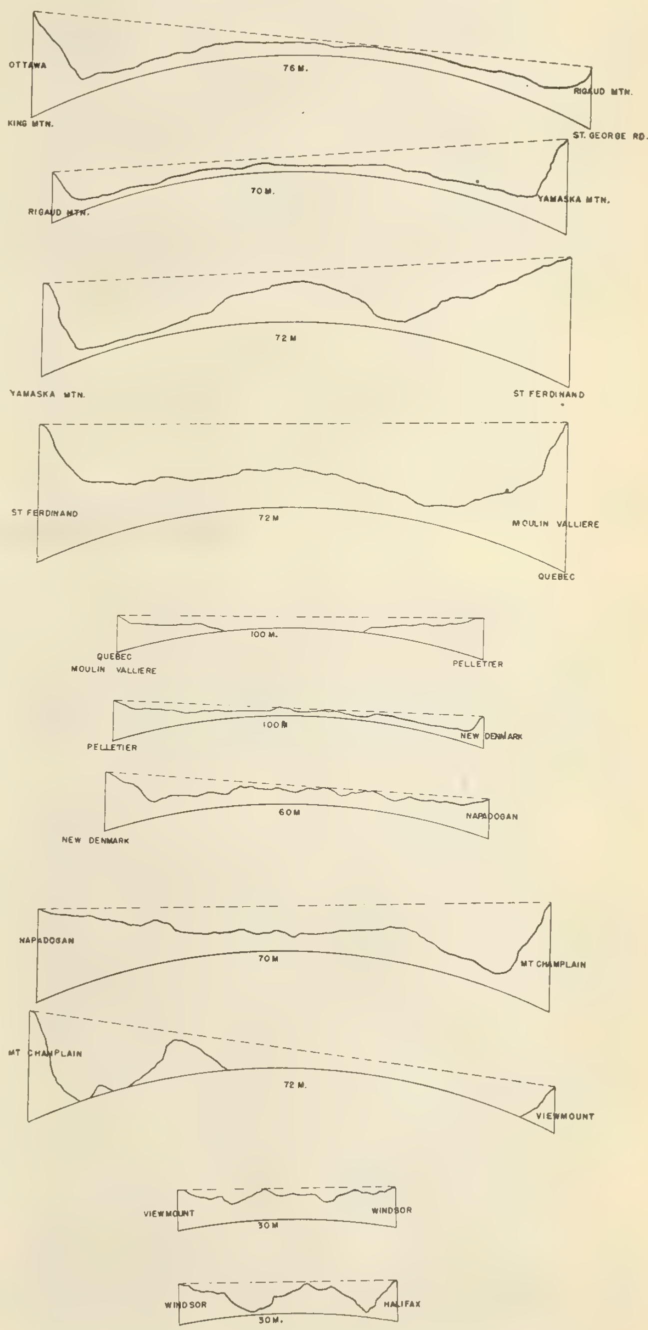

Fig. 15—Contours of the route shown in Fig. 14.

half of the band the antennas are so small that they can be readily enclosed completely so that icing and other weather conditions impose no hazards whatever.

Alternate forms are possible. One is in the case where a wave guide is used as a transmission line using a horn radiator. This is a simple metal structure much like an acoustic horn, and of the same order of dimensions. It provides an efficient and directional radiator. Another form of directional antenna is the parabolic reflector, and this is useful particularly on the upper end of the band where the source of energy in the reflector is a dipole of very small dimensions. Such reflectors can be constructed either from solid sheet metal, or from wire mesh, and when the frequency is very high are small enough to be completely enclosed if this is so desired. The design, construction, and installation of any of these forms of antennas is a straightforward operation requiring no extensive research, experimentation, or field adjustment.

A cost estimate of the whole system which is outlined above can be arrived at to a fair degree of approximation, and it is estimated that the whole cost of the system will lie between $300,000 and $350,000. This includes equipment, engineering, construction of buildings and antennas, cost of land, clearing of sites, construction of power lines and road, and maintenance equipment spares for one year's operations. It includes the carrier terminal equipment for four telephone and four telegraph channels. It will be recognized that such a cost is only a fraction of that which would be involved in the construction of similar facilities by existing methods. It should also be noted that the capacity of this system could be expanded from four telephone and four telegraph channels to a very large number of channels at an additional cost involving only terminal equipment and installation, and very little for construction and engineering.

Maitenance and operating costs on this system would be rather low. Since no operating personnel would be required, and only two or three maintenance men, the labour cost of operating would be very small. Maintenance on buildings and antennas similarly should be small over a ten or fifteen year period. All in all, the maintenance and operating costs will be only a fraction of conventional circuits consisting of open wire lines, repeater stations with attendants, etc.

A system such as the hypothetical one described could be used for all the needs of our commercial communication systems. It is suitable for transmission of voice-frequency telephone channels, carrier-telephone channels up to a very large number of circuits, possibly as many as 100, for the transmission of programmes for broadcasting service, and for transmission of all types of telegraph service, either on carrier channels or not. It would be suitable for specialized telephone as well as public telephone service; for example, for flight control in airline operations, etc. The example given has been worked out in some detail because it is felt to be of the utmost importance to demonstrate that the general application of ultra-high-frequency FM radio to commercial communication problems is now a matter of practical possibility.

THE FUTURE OF COPPER

What will be the prospective position of copper in the post-war world? What will its competitive place be in relation to plastics and the newly developed metals and their alloys?

Since pre-historic times, copper has served man in an ever-widening variety of uses, because it alone combines the qualities of strength, malleability, electrical and thermal conductivity and resistance to the corrosive action of atmosphere, sea water, and other chemical media.

Immediately prior to, and during the war, when the "red metal" was almost entirely diverted to the manufacture of war materials, substitutes were born of necessity, many of which have proved highly successful, and are undoubtedly here to stay. Will they replace copper? Not according to a recent extensive survey conducted in the United States by one of the great producers of copper among some hundreds of its biggest customers! These, representing the automotive, electrical, building construction, hardware, machinery and equipment, metal working and other industries, actually expect to use a great deal more copper than ever in the period immediately after re-conversion. Because most of the firms contacted have branches here, the outlook is similar for Canada.

The machinery and equipment industry was taken as an illustration, including three over-all types:—

1. Machinery and equipment for general industrial purposes.
2. For particular industrial purpose.
3. Specialized machinery and equipment employed in the manufacturing processes of individual industries.

In the first or general group, those concerns who service the public utility and processing industries look for a marked development in business during and after re-conversion. This would indicate a stepped-up demand for muntz and naval brass sheet and admiralty and copper tube used in condensers and heat exchangers. Miscellaneous equipment for compressors, pumps, valves and such items as bearings, expansion joints, gaskets, gears, lubricating devices, industrial screen cloth, etc., will consume copper and brass. Brass and bronze rod will find extensive use in valve stems and brass tube for pump liners. Light and power companies expect heavy replacements that will entail the use of alloy tube for steam condenser units and special copper alloy wire and copper bus bar for power installations. Gas and water utilities indicate their intention to employ copper tube for service lines.

Machinery and equipment manufactured for particular industrial purposes, will show a decided increase over pre-war levels, the two chief outlets being welding and metallizing equipment and air-conditioning and refrigeration equipment, both of which will capitalize on the essential properties of copper and copper base alloys. Great strides made in the art of welding and metallizing, as in the repairing of machinery by bronze welding, building up of worn surfaces by metal spraying, and fabrication and assembly of metal products by fusion welding, all point to a substantial demand for welding rods of every type. Air conditioning and refrigeration equipment for commercial use, immediately prior to the war, showed signs of becoming one of the most important outlets for copper and brass. The thermal conductivity and resistance to corrosion of copper will very likely make it first choice in the construction of condensing and heat exchange units. Present post-war plans of leading manufacturers of machinery and equipment for office and laundry use, for construction, mining, excavating and metal working as well as for public service, and fire-fighting purposes, are based on the continued use of copper and copper base alloys.

Among the outstanding uses of copper and brass for machinery and equipment are those in the special industrial fields. Agricultural, chemical, petroleum, pulp and paper and textile industries, to mention only a few, will specify copper and copper-rich alloys, wherever resistance to corrosion, thermal conductivity and workability are prime requisites.

From Month to Month

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

FIRST REPORT ON REHABILITATION

Now that the rehabilitation service has been set up, it is proposed to issue a report every month, through the *Journal*. In this way members both at home and overseas may be kept in touch with what will shortly become one of the Institute's most pressing activities.

As reported previously, a letter and questionnaire have been sent to every member in uniform. The replies are now being received at the rate of about six a day, and make very interesting reading. The pattern is not exactly that which was anticipated. In fact it shows that the need of this service is greater and the complexities more numerous than had been foreseen.

It is gratifying to see that the proffered service is welcomed. Almost all returned questionnaires or accompanying letters express appreciation, even from those whose postwar plans are satisfactorily completed. It is indeed encouraging to carry on the work under such circumstances.

The type of assistance which is required is indicated by the following analysis:

The number of questionnaires received to date is 224. Classified as follows:

(1) *Those who require no assistance*—78

(2) *Asking for assistance:*

(a) Those who have prewar positions to return to but are undecided about returning to them or are definitely unwilling to do so:		
(i) undecided	16	
(ii) unwilling	41	— 57
(b) Those who have graduated since the beginning of the war and have immediately entered the services, or temporary war work:		
(i) entered the services on graduation	14	
(ii) temporary war work	22	— 36
(c) Interested in further education (not included in above):		
(i) desiring post-graduate courses	28	
(ii) undergraduates wanting to finish	4	
(iii) desiring refresher courses.	21	— 53
* TOTAL		146

The services of the members from whom answers have been received are:

24% in Navy
47% in Army
29% in Air Force

41% have seen overseas service.

More than 90% have served or are serving in a technical capacity.

7% hold rank higher than Lieut.-Col. or equivalent.

25% hold the rank of Major or Lieut.-Col. or equivalent.

63% hold commissioned rank up to and including Captain (Army) or equivalent.

5% hold non-commissioned ranks.

The requests for information and assistance are so varied that it will be some time before all can be answered. However, all are in hand and every effort will be made to keep up to date with replies. Already several placements have been made.

Recommendations

It appears that at least one-third of the members in uniform, or between four and five hundred engineers, are going to require new positions after demobilization. It is therefore suggested that from the point of view of both employer and prospective applicant for employment, contact could usefully be established now. This can be arranged easily if companies that may be able to employ more engineers would make known to the Institute the number and type of persons they expect to be able to use. In this way preliminary negotiations may be started quickly which will be helpful to the man still in the service. It will be comforting to him to know that there are places that are interested in employing him after demobilization. Too, it is quite possible that in individual cases demobilization might be expedited if useful employment is awaiting discharge. Members who have openings for employment now or who expect to need men later are asked to communicate with the rehabilitation officer at Headquarters.

* From these figures it is seen that sixty-five per cent, or about two-thirds of the replies contain a request for information or assistance.

PRESIDENT VISITS MARITIMES

The traditional hospitality of the Maritimes was amply exhibited to Dean Fetherstonhaugh and Mrs. Fetherstonhaugh during their two weeks visit there. It is encouraging to see the increasing activity in the smaller branches and the general enthusiasm throughout. No presidential tour has prompted larger attendances at meetings or offered more diversions of a social nature.

The officers of all branches co-operated to establish new records for almost every function and to provide a programme full of interest and activity. As this was the first trip to that part of Canada by the president and Mrs. Fetherstonhaugh, arrangements were made to show them a great deal of the country, in the time available between meetings.

The presence at some or all of the branch meetings of officers from other branches was a pleasant feature. J. B. Stirling chairman of the Montreal Branch and of the Committee on Professional Interests, at Halifax and G. A. Gaherty of Montreal, a member of the Finance Committee, at Saint John and Fredericton, and Geo. A. Dickson throughout the tour, were very welcome visitors. The addition of such members to the president's party is a manifestation of the national character of the Institute.

Following established custom the president spoke to

Left to right (seated): **Mrs. L. E. Mitchell, Mrs. E. P. Fetherstonhaugh, Mrs. P. A. Lovett, Mrs. J. R. Kaye, Mrs. S. W. Gray.**

Left to right (standing): **Mrs. C. Scrymgeour, Mrs. G. J. Currie, Mrs. E. C. O'Leary, Mrs. H. A. Ripley, Mrs. K. A. Forbes, Mrs. F. H. Sexton, Mrs. J. W. March.**

engineering students at all universities, emphasizing the need of an efficient utilization of time both in college and in professional practice. He also presented the Institute prize at Nova Scotia Technical College and the University of New Brunswick.

At the branches the president spoke on the trends in engineering education, pointing out the desirability and the proposals to include more of the humanities, and also the difficulties of finding a sufficient place for them in an already crowded curriculum. His prominent position in the educational world and his study of the subject enabled him to give a very clear picture of what is ahead.

The tour started with the president's departure from Winnipeg on Friday, April 6th. During his stay of a day in Montreal he and Mrs. Fetherstonhaugh were guests at a luncheon given by Past-President deGaspé Beaubien and Madame Beaubien at their home. At Montreal he was joined by the general secretary and the group departed on the night of April 9th, going direct to Sydney, Nova Scotia. At Moncton, George L. Dickson, vice-president for the maritime provinces, joined the party.

At Sydney there was an inspection trip through the steel plant in the morning and a visit to the Naval Station Protector No. 2 in the afternoon, where the party, after looking over the plant, was entertained at tea by Capt. J. McCullouch. Commanders Orde, Wells and Killop also took part in showing the Naval Station to the visitors.

The branch meeting was a dinner held under the chairmanship of Murray Cossitt, but upon the announcement of the branch election results was concluded under the chairmanship of J. A. Macdonald, the newly elected chairman.

The number in attendance was the largest that has participated in a Sydney meeting for a long time and attests strongly to the active policy initiated by the secretary-treasurer of the branch, S. G. Naish.

The following day the party left by train, arriving in Halifax that evening where they were met by officers of the branch and the Association of Professional Engineers of Nova Scotia and J. B. Stirling, chairman of the Montreal Branch and chairman of the Institute's Committee on Professional Interests.

The next day, Friday, was devoted almost entirely to attendance at the meeting of the Council of the Association, to which the president's party had been invited. J. R. Kaye, president of the Association, presided. At noon the president left the council meeting to speak to the students of Dalhousie, St. Mary's College and the Nova Scotia Technical College in the auditorium of the latter institution. Dr. F. H. Sexton, president of the college, presided. President Fetherstonhaugh presented The Engineering Institute of Canada Prize to John William Powers, S.E.I.C.

The branch dinner was held that night, under the chairmanship of Lawrence E. Mitchell, the chairman of the branch. Distinguished guests at the head table included Rear Admiral L. Murray, Air Vice-Marshal Morfee and Brigadier White, representing the three services, Mayor J. A. Lloyd and J. B. Stirling. A feature of this meeting was the presence of thirteen graduates of the University of Manitoba who had the opportunity of a short interview with the president at the conclusion of the dinner. While the men were dining at the Nova Scotian Hotel, Mrs. Fetherstonhaugh and the wives of the executive were dinner guests of Mrs. Percy Lovett at the Lord Nelson Hotel.

On Saturday morning there was a tour of the harbour arranged by E. L. Cousins, which proved to be one of the most interesting features of the whole maritime trip. In the afternoon officers of the branch drove the party down the coast as far as Chester, returning to Queensland, meeting the other members of the branch executive and their wives at the Seabreeze Hotel, where a shore dinner was enjoyed by everyone. There were twenty-eight present.

On Sunday a tea was given at the home of Mr. and Mrs. G. J. Currie, and in the evening the group gathered gain at the home of Mr. and Mrs. S. W. Gray.

Monday morning, the president and party, in company with Mrs. S. W. Gray, Mrs. C. Scrymgeour and L. E. Mitchell, drove to Wolfville where a meeting was held with the students at Acadia University. The chair was occupied by Acting Dean Bernard Cain. President F. W. Patterson and Professor M. S. Macphail were also present. Lunch at the Cornwallis Inn at Kentville preceded the visit to Acadia.

The following morning, Tuesday, April 17th, the party entrained for Sackville, N.B., where they were met by Dr. H. W. McKiel, dean of engineering of Mount Allison University. After a short inspection of the art gallery and other buildings, the president and the general secretary spoke to the students, Byron Kerr, president of the Engineering Society, acting as chairman, and Dr. McKiel introducing the speakers.

From there the party motored to Moncton, making train connections which brought them to Saint John the same evening where they were joined by G. A. Gaherty of Montreal and M. Donald of Halifax. At noon on Wednesday the executive of the branch entertained the party at luncheon at the Admiral Beatty

Left to right: **J. B. Stirling, Rear-Admiral L. Murray, President Fetherstonhaugh, L. E. Mitchell, Mayor J. A. Lloyd, Brigadier D. A. White, G. L. Dickson and J. R. Kaye. Others at head table not in picture: S. W. Gray, Air Vice-Marshal A. L. Morfee and the general secretary.**

Hotel, and the afternoon was spent at an informal meeting with the Council of the Association of Professional Engineers of New Brunswick discussing affairs of common interest. Mr. A. S. Gunn, president of the Association, presided.

On Wednesday night the branch meeting was held, to which the ladies were invited. It was a dinner meeting at the Admiral Beatty Hotel under the chairmanship of C. D. McAllister. Head table guests included His Worship Mayor McKenna, Capt. Heenan representing the Navy, and Colonel Durward the Army. There were three toasts, one to the city, proposed by John N. Flood and responded to by the Mayor; one to the ladies proposed by T. C. Macnabb, responded to by Mrs. E. P. Fetherstonhaugh, and one to the Institute proposed by A. A. Turnbull and responded to by the president.

On Thursday morning, accompanied by officers of the branch and their wives, the group was motored to Fredericton where luncheon was had with the students, and Milton F. Gregg, president of the University of New Brunswick, and members of the staff. Fred Davidson, president of the undergraduates society, was in the chair. At the same time, Mrs. Fetherstonhaugh was entertained by wives of members at the home of Mrs. B. H. Hagerman.

After lunch, the president and the general secretary spoke to the students, Dr. E. O. Turner introducing the visitors, and also introducing Vice-President Dickson and C. D. McAllister, chairman of the Saint John Branch, both of whom addressed the meeting briefly. The Engineering Institute of Canada Prize was presented to Ottis Logue, S.E.I.C., by President Fetherstonhaugh. The afternoon was concluded at the home of Dr. and Mrs. E. O. Turner where tea was served to the visitors, members of the staff and officers of the undergraduates society. The party returned to Saint John the same evening.

On Friday, the 20th, the president and entourage arrived at Moncton at noon, and in the afternoon the President and Mrs. Fetherstonhaugh were motored out to see the famous "magnetic hill" which still remains one of the nation's greatest illusions.

The branch dinner was held at the Brunswick Hotel, the ladies being present. Unfortunately the chairman of the branch, A. S. Donald, was absent from the city, but in his place Vice-President George L. Dickson acted very acceptably. Mr. Dickson introduced the visiting councillors, A. A. Turnbull from Saint John, J. A. Russell from Sydney, P. A. Lovett, A. E. Flynn from Halifax and L. E. Mitchell, chairman of the Halifax Branch. The Hon. Michael Dwyer was also present and, at the chairman's invitation, added considerable merriment to the occasion.

On Saturday morning a regional meeting of Council was held in the Brunswick Hotel with councillors present from all maritime branches. The meeting carried on into the afternoon and at its conclusion the councillors were joined by officers of the branch and their wives and all motored to Buctouche where a most delightful oyster and chicken dinner was enjoyed. A feature of the dinner was the description of the proposed Petitcodiac tidal power development given by Geoff Parsons, president of the Moncton Board of Trade. Mr. Parsons circulated copies of preliminary plans which aided considerably in following his description.

From Buctouche the party returned by motor to Moncton where the president, Mrs. Fetherstonhaugh and the general secretary entrained for Montreal.

PROPOSALS FOR CHANGES IN ADMISSION AND TRANSFER PROCEDURES

The following report was presented in draft form at the February meeting of Council in Winnipeg at which time the chairman was asked to complete it for final presentation. In its present form it was discussed at the April meeting of Council in Moncton and is being published herewith so that members may be informed.

All members are invited to make comments which should be addressed to the chairman, John G. Hall, 711 C.P.R. Building, Toronto 1, Ontario.

At Council Meeting held in Winnipeg on February 6th, last, your Membership Committee submitted a report dealing with the automatic transfer of Students and Juniors. After considerable discussion, it was agreed that the report with suitable revisions should be published in the *Journal* and that members of the Institute be urged to comment on the various recommendations.

At the December 1944 meeting of Council, Mr H. R. Sills presented a recommendation from the Peterborough Branch dealing with this matter and your Membership Committee was asked to study the problem and report to Council.

In the past it has been difficult to get Students and Juniors to transfer to higher grades as soon as they were eligible. In addition to the extra work placed on the already overburdened Headquarters staff, the Institute has been losing badly needed revenue.

In considering the various recommendations, three particular points were kept in mind, namely the reputation of the Institute, the reduction of work at Headquarters and the financial return. Although all three are important, the reputation of the Institute should always take precedence.

Students

1. (a) Students should be automatically transferred to the grade of Junior two years after graduation without the necessity of making formal application or paying transfer fee.

(b) In the case of non-graduates present by-laws should still apply.

Juniors

2. (a) Six years after graduation, or at age 33, whichever comes first, each Junior should be sent an application form for transfer to Member and all particulars available referred to the branch in question for careful investigation and report to Council. If Council decides he is eligible, he should be notified of his transfer to grade of Member without payment of transfer fee. The suggestion has been made that when the above time limit has been reached, a Junior, considered ineligible for the grade of Member, should pay full membership dues and remain a Junior, but your Committee does not consider this equitable.

It is recommended that an adequate period be allowed for the person in question to submit his application and for the branch to complete its appraisal form before the case is considered by Council.

(b) In the case of non-graduates present by-laws should still apply.

(c) It has been proposed also that the grade of Junior should be eliminated. This was discussed at the February Council meeting, but as it is a radical step, it was decided that the matter should be referred to the membership at large for comment.

This proposal would simplify our classifications and might assist in negotiations with the various provincial associations which have different entrance qualifications. In the medical and legal professions there is nothing similar to our grade of Junior. Should the grade of Junior be eliminated, it would probably be advisable to increase the duration of Student grade to three years.

Admissions Committee

3. (a) As mentioned in a previous report to Council, your committee strongly recommends the appointment of an Admissions Committee, or Standing Membership Committee, the chairman of which should be a member of Council. This committee should carefully review all applications and present them to Council in three lists:

i—Those which meet requirements;
ii—Those which do not meet requirements;
iii—Borderline cases.

Only those in Class-iii should be considered individually by Council, while those in Class-1 and Class-ii should be considered as a whole unless some member of Council desires further information regarding any particular case.

The value of this arrangement was very clearly demonstrated at Winnipeg where a great deal of Council's time was taken up discussing details of several borderline cases which could have been saved for more important matters, had such a committee collected all details and submitted proper recommendation.

(b) In the past, your committee has stressed the importance of branch reports on applications and the use of appraisal forms already approved by Council. It is believed Branch Membership Committees, which usually act for one year only, should be instructed upon their appointment regarding careful investigation of each application and proper use of the appraisal forms.

After comments have been received from members and branches, your committee will be pleased to give the question further consideration to make a final report.

Yours sincerely,

(*Signed*) John G. Hall, *Chairman*
Membership Committee

ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

A Message to Each Engineer from the Chairman

Everett S. Lee

The semi-annual meetings of Engineers' Council for Professional Development have just been completed and I hasten to tell you of the work. I am sure you will be pleased with the progress for good, even in these busy times of high pressure of war production work in which the engineers are so effectively engaged.

Our committee chairmen met the first day of our two-day meeting. President A. R. Cullimore, chairman of the Committee on Student Selection and Guidance presented his report of full activity. Work in guiding returning veterans is in substantial progress. Though there are many agencies engaged therein, President Cullimore's committee feels that fully 75 per cent of this work in community projects is done by high school people. Thus our efforts as in the past for young engineering students will be continued through the high schools. This will be of particular interest to local coordinated Engineering Councils to progress this work effectively. To this end President Cullimore asked approval to print 25,000 more copies of "Engineering as a Career."

The second of President Cullimore's projects is that of the Measurement and Guidance Project in Engineering Education which is being progressed by Dr. K. W. Vaughn of the Carnegie Foundation. This work promises to give us test data for the evaluation of the engineering student. The initial test results from some 10,000 entering engineering students into 26 collegiate schools will be the subject of a report to be issued soon. ECPD is proud to have been instrumental in starting this work and to be associated with it when in the future it should have lasting benefit, as it already has had present benefit.

Dr. D. B. Prentice reported for the Committee on Engineering Schools. This is the committee which is responsible for the accrediting of collegiate curricula and whose contributions throughout these past twelve years has been so substantial. Now, following their request, the committee has set itself up to accredit technical institutes. This work has now started. We in ECPD feel that with the growing opportunity of the technical institute the accrediting programme will provide the basis of an orderly evaluation of the place of the technical institute graduate. This is of fundamental importance to the engineering profession.

Dr. Prentice also reported that the "Guide" for academic credits for war-connected educational experience was in circulation and that it has been a great success. This allows an evaluation for credit of the many courses given during these war years. The magnitude of this project was enormous. Under the auspices of the American Council on Education, ECPD contributed both in material and in means. We are proud also to have been associated with this most worthy enterprise.

You are all interested in the status of the engineering schools today. The last paragraph of Dr. Prentice's report is most interesting. I am quoting it completely:

> Enrolments at engineering colleges are very low, not over a third, counting freshmen, of five years ago. Nearly sixty per cent of the students are freshmen so that above this class, present enrolment is approximately twenty per cent of pre-war, with senior class registration down to one-sixth. In spite of this condition, most engineering schools are carrying on their programmes with little reduction from normal. Smaller classes will more than offset other disadvantages so that graduates of these years, it is believed, will be as well trained as under ordinary conditions.

This is a statement to bring hope to you in spite of dire conditions. And until college graduates are again entering our profession normally, the load usually carried by the younger engineers will have to be carried by the returning veterans. This is a logical situation which we can make as effective as the normal situation if we give our attention to it.

Dr. Pohl's report of the Committee on Professional Training told of the Junior Reading List which has been prepared. A large edition has been printed. You can obtain a copy from ECPD, at a nominal charge. You will want a copy.

We are all looking forward with great interest to the ECPD Manual for Junior Engineers which Dr. W. E. Wickenden is writing for us. This will be the

Engineer's Handbook of the Engineering Profession. In the hands of the student, the professor, the employer in industry it will give a coordinated picture of the engineering profession and the part each engineer plays in it. This is one of our future gems, and you will hear much more of it in the days to come.

Dean Dougherty could not be present to give the report of the Committee on Professional Recognition but the report of the committee was presented by George Stetson. This is the committee under the chairmanship for these previous years of Charles F. Scott, beloved of all engineers. His death last winter took from us a great friend. His presence everywhere brought enthusiasm for the engineer and the engineering profession. Dean Dougherty's committee plans to continue the work which Dr. Scott has pressed forward with such vigour.

Mr. Boughton reported for the Committee on Employment Conditions for Engineers. His report is a résumé of the actions in the respective Societies. As these have been printed in the Societies' journals they are familiar to you. I will not repeat them. But I will say this. Wherever I go engineers ask me what stand ECPD has taken on collective bargaining. The answer is ECPD has not taken action on this subject. When I am asked my thoughts, I say, I trust each engineer will study to the very end the ramifications of collective bargaining and all that it entails and all that it involves before he enters it from his accustomed position of freedom of action. If he finds it advantageous and worth the amount of freedom he gives up together with the complexity he assumes by entering therein, why well and good, but it is my firm conviction from study and thought that he will be in infinitely better position if he puts his energies into bringing about a realization of the true position of the engineer and of the engineering profession so that he will enjoy the freedom which is rightfully his by reason of the fundamentality of his contributions. The engineer has a most convincing statement to make of his position. Let him make it with conviction and with courage. I am confident he will be accorded the place which the profession justifies. May the engineer look upward to better ways.

Dr. Jackson reported for the Committee on Principles of Engineering Ethics that the work of writing a Canons is progressing. The " Faith of the Engineer " published last year has been most enthusiastically received.

The second day of the meeting was reserved for the Executive Committee of Council. The necessary routines of committee appointments were accomplished. The reports of the committees of the previous day were studied and accepted. A budget was adopted. This was for some $18,000. The work for the next six months and looking into the next year was established.

You will be interested particularly in some of the actions. You will be interested in the work of the Consultative Committee on Engineering of the War Man-Power Commission. Appointed by Mr. McNutt in the fall of 1943 we appeared in Washington to plead for the engineer. We showed the need to the nation that he be continued in his collegiate training and industry. We did not get all we asked but we were told that we did bring a picture of the engineer and his contributions to the war which was received with favour and regard. And now Mr. McNutt has asked that the Engineers' Council for Professional Development appoint a representative to the Citizens' Federal Committee on Education which he is setting up in the Federal Security Agency. The other two professions so recognized are the American Medical Association and the American Bar Association. I well remember hearing many times from my engineering associates—why do we not have recognition such as accorded the doctors and the lawyers. I say we have it and we can continue to have it if the engineers will give some of their time to the doing of these things. This is important and it must be progressed with vigour. This is a necessary part of recognition and the more it is recognized and practised the greater will be the participation of the engineers therein. This is a condition which engineers must recognize if they are to have accrue to themselves the position for which they are eager.

And yet we do have that position by virtue of the accomplishments of those who have preceded us and who have given of their time and thought and energies to these things. Let each engineer ask himself how much time he has or he is giving to the progression of the engineering profession. If it is meager then there is still time for him to do more.

I call upon each engineer to give thought and study and time to the opportunity through the ECPD for the advancement of the profession. Will You Help!

Everett S. Lee, *Chairman,*
Engineers' Council for Professional Development.

P.S. I have written the above just as though each engineer knows what ECPD is and what it is doing. In the event you do not know of ECPD I will say it is a conference organized to enhance the professional status of the engineer through the cooperative efforts of the following national organizations, concerned with the professional, technical, educational, and legislative phases of engineers' lives.

American Society of Civil Engineers
American Institute of Mining and Metallurgical Engineers
The American Society of Mechanical Engineers
American Institute of Electrical Engineers
The Engineering Institute of Canada
The Society for the Promotion of Engineering Education
American Institute of Chemical Engineers
National Council of State Boards of Engineering Examiners

ECPD operates by developing procedures to be recommended to the sponsoring organizations, and administering such procedures as are approved, functioning through standing committees on Student Selection and Guidance, Engineering Schools, Professional Training, and Professional Recognition, or through such new committees as may be established.

The objectives of ECPD are to coordinate and promote efforts to attain higher professional standards of education and practice, greater solidarity of the engineering profession, and greater effectiveness in dealing with technical, economic and social problems.

If you have any questions regarding ECPD, or wish any of the publications, if you will write to Engineers' Council for Professional Development, 29 West 39th Street, New York 18, New York, or in Canada to The Engineering Institute of Canada, 2050 Mansfield Street, Montreal, your communication will be received and answered.

(*National Film Board Photo*)

The Advisory Board, Wartime Bureau of Technical Personnel, meets in an office in the Department of Labour at Ottawa.

Left to right (seated): **Dr. L. A. Wright, general secretary, The Engineering Institute of Canada, representing the E.I.C.; Dean D. S. Ellis, Dean of Faculty of Applied Science, Queen's University, representing the universities; Mr. Alex E. MacRae (chairman), consulting engineer and patent attorney, Ottawa, representing the Provincial Professional Associations; Dr. Paul E. Gagnon, Professor of Chemistry, Laval University, representing the Chemical Institute of Canada; Mr. E. J. Carlyle, general secretary, Canadian Institute of Mining and Metallurgy, representing the C.I.M.M.**

Left to right (standing): **Mr. J. M. Dymond, chief executive officer, Wartime Bureau of Technical Personnel; Mr. M. F. Goudge, Department of Mines and Resources, representing the Canadian Institute of Mining and Metallurgy; Mr. H. W. Lea, director, Wartime Bureau of Technical Personnel; Mr. I. S. Patterson, general personnel adviser, Wartime Bureau of Technical Personnel. Mr. L. C. Jacobs, director of construction, Department of Munitions and Supply, Ottawa, representing The Engineering Institute of Canada.**

WASHINGTON LETTER

The President is Dead

News over the last month of great and stirring events has helped soften the shock and sadness of the President's passing. He was a man of crises, accustomed to wresting victory from disaster. The last month has seen the world which he served so well move ever closer to the goals he expended his life to achieve. Not his the fault if we fail now. His death was of a piece with his life. It was swift and incisive, and had all the elements of drama and superb timing. Anti-climax he could not have stood. At the peak of his power and prestige, he takes his certain place among the great of history.

In two fundamentals he changed the outlook of his people. Creating opportunity from despair, he re-oriented the economic domestic life of the United States towards greater social responsibility. In international affairs, he turned the eyes of his people towards the broader horizons of world responsibility and leadership. Leading his country out of mortal danger, first domestic and then international, he was himself an era.

So far forward has he carried his country that his causes may well fare better in hands of other men less prescribed by jealousies, more schooled by necessity in the arts of compromise, more persuasive by virtue of enforced humility. President Truman has shown himself a worthy successor and a good disciple. There has been a noticeable and heartening closing of the ranks, both in a domestic and in an international sense.

Stirring Events

Since the last letter was written the Rhine has been crossed in great force. Most of Germany has been overrun. Berlin and Vienna have fallen. Iwa, Okinawa, and Ie are taken, and much of Tokio is in ruins. Russia repudiated the Japanese pact. The Japanese war cabinet resigned. The Pan-American Treaty of Chapultepec has been signed. The Lend Lease Act has been extended for another year. Before he resigned, Mr. Byrnes issued a stirring and forward-looking report. No fewer than eighteen bills are at present before Congress in implementation of the recommendations of this report. Top vacancies in the important posts of War Mobilization and Reconstruction, Federal Loan Administration, Export-Import Bank have all been well and happily filled. Tough, hard-hitting, highly efficient General Clay has been named Eisenhower's deputy in charge of civil affairs in occupied Germany. (A long standing friend in supply matters, I had occasion to write him our congratulations on three counts at once. He was also recently awarded the Legion of Merit and the Distinguished Service Medal). Plans for the vitally important San Francisco Conference have moved forward in spite of setbacks and some disappointments. At Mr. Truman's request, Marshal Stalin has sent Commissar Molotoff. At one crucial point in preliminary negotiations, the cheerful optimism and drive of Secretary Stettinius stood all in good stead. Said he, "We shall not succeed if every road block or land mine on the road to peace throws us into a panic and, conversely, if every hundred years of clear going makes us think there is nothing more to worry about."

Grim Winter Ahead

It is most important, however, that the stirring developments of the last month should not obscure the extremely difficult job remaining to be done in Europe, quite apart from the Pacific. In many ways, the very speed of the occupation of Germany makes the position much more difficult. Our situation in Germany will now be the same as it was in other occupied countries. We, and not the Germans, will have to shoulder the responsibility for the maintenance of life and the continuance of essential services and relief. We will have to do this under conditions much less favourable than those obtaining before we took over, desperate though they may have been. There are some who hint that the speed and extent of the German withdrawal may be a kind of political sabotage calculated to throw an almost impossible problem into the lap of the United Nations. With typical German thoroughness, the problem will be further complicated by a ruthless, well-organized and carefully planned underground sabotage movement. It was no doubt with these facts in mind that General Eisenhower wrote his recent letter to the President on the postponement of V-E Day. Officials returning from Europe all bring the same story. Irrespective of the military situation next winter will be desperately difficult. It will be far the worst winter that Europe has so far experienced. Coal, food, and transportation will all be critical and probably below subsistence requirements. I was talking recently to the head of the Netherlands Mission. Conditions discovered in reoccupied Holland are quite beyond the reach of the imagination of those of us who are fortunate enough to enjoy the security of countries removed from the actual ravages of war. Food is not the first requirement of the unfortunate Netherlanders. General starvation has gone beyond that point and the great need is for blood transfusions before people are able to begin to return to any semblance of normal diets. Vast tracts of land flooded with salt water will take years to recuperate. Dikes and canals have been destroyed and the barges which carry the life of Holland have been sunk or confiscated. Hardships are even worse than those visited on Holland after the Spanish Wars, and the terrible question is "How many will not survive the next few weeks ?". Far from ceasing with V-E Day, the responsibilities of the more fortunate members of the United Nations will in many regards increase and become more difficult—more complicated. It will be an immense task to obtain the appropriations, the supplies, and the help in sufficient quantities for countries suffering the worst ravages of war, and to obtain this help from more fortunate countries who, by virtue of their very position, will be bending their efforts to return to civilian production and to put wartime controls and restrictions behind them.

Williamsburg

In lighter vein and by way of exemplifying contrast, it was possible recently for me to spend a day revisiting colonial Williamsburg. It was the week before Easter and the cherry blossoms, apple and flowering quince, and, best of all, the redbud, were in the height of their glory. The sense of interdependence and inter-relation of British and American history and customs and tradition which one feels on visiting Williamsburg and its historical surroundings such as Yorktown, Jamestown and Richmond, seemed stronger than ever. The foyer of the delightful Williamsburg Lodge is dominated by an excellent life-size oil portrait of Prime Minister Churchill. After a few minutes pleasant walk, one can be standing in the Great Hall at William and Mary College, the central building of which was designed by Christopher Wren. Much of Williamsburg is restoration but this original Wren building is still extant and is still in active use. Along one wall of the Great Hall are portraits of the Randolph family. It is presumed that this may be an early branch of the American ancestors of Mr. Churchill. The remains of several of the most illustrious members of this family lie buried under the crypt of the chapel. His American connections enable Mr. Churchill to see a great need and meet it by a bold stroke of imagination which sweeps aside the many difficulties. He recently made a proposal for a common or joint citizenship for the peoples of the United States and the United Kingdom.

The President's Funeral

It was with very deep regret that I had to be out of Washington on the day of the President's funeral. My wife tells me that the funeral procession and the silent sorrow of the great crowds was very impressive. It so happens that I was returning to Washington at the time that the President's funeral train was about to leave for Hyde Park, and we were due to pass just outside Washington. Just before Baltimore I went and stood on the observation platform at the rear of the train. It was after 10.00 o'clock at night. At each station, both sides of the tracks were guarded by soldiers spaced at about ten paces. Behind them were crowds of silent people just waiting to see the train go by carrying the President on his last ride. The sight was repeated over and over again all the way into Washington. At each small crossing and way-station there would be guards and more crowds. The funeral train was in two sections. The first section carried the press and some officials. After the first section had passed, we watched the block signals, and finally saw the poles light up from the approaching headlights of the President's train. We slowed almost to a stop to let it pass. It also was travelling comparatively slowly for the benefit of the crowds. It was a beautiful train of some twelve or fifteen matched black cars drawn by two of the largest type diesel electric locomotives, also black and highly polished. While the train carried the official party and leading members of the government and the services, the curtains were drawn in nearly all the carriages except the last. This was the President's carriage, and it was the one he used as his office when travelling. This was fully lighted and the curtains were all up, and the rear of the carriage was open. Armed guards representing all the services attended. The flag-draped coffin sat at the very end of the carriage. I shall always remember that scene, and the patch of light diminishing into the night dominated by the brilliant splash of colour made by the draped Stars and Stripes.

E. R. Jacobsen, m.e.i.c.

April 24th, 1945.

MEETING OF COUNCIL

A regional meeting of the Council of the Institute was held at the Brunswick Hotel, Moncton, N.B., on Saturday, April 21st, 1945, convening at ten o'clock a.m.

Present: President E. P. Fetherstonhaugh (Winnipeg) in the chair; Vice-President G. L. Dickson (Moncton); Councillors A. E. Flynn (Halifax), P. A. Lovett (Halifax), E. B. Martin (Moncton), J. A. Russell (Sydney), A. A. Turnbull (Saint John), and General Secretary L. Austin Wright.

There were also present by invitation—Past President H. W. McKiel (Sackville); A. S. Gunn (Moncton), president of the Association of Professional Engineers of New Brunswick; L. E. Mitchell, chairman of the Halifax branch; V. C. Blackett (Moncton), past-councillor and secretary-treasurer, and A. Gordon, member of the executive of the Moncton Branch.

In welcoming the councillors and guests, President Fetherstonhaugh invited everyone present to take part in the discussions. He felt that regional meetings of council were very helpful as they gave the councillors in the different parts of the country an opportunity to attend and to assist in the deliberations.

Rehabilitation of Members in the Armed Forces—

The general secretary reported that since the last meeting of Council, in accordance with authority previously given by Council and with the approval of the Finance Committee, Major D. C. MacCallum had been engaged as Rehabilitation and Personnel Officer of the Institute. After four and a half years' service overseas, Major MacCallum has just been released from the Army because of wounds. There has been a good response to the questionnaire — about 2/3 of those replying have indicated that they would appreciate some help and advice from the Institute in getting rehabilitated.

Community Planning—The general secretary reviewed the situation with regard to the Institute's interest in community planning. At the last meeting of Council the Toronto councillors had been appointed a committee to recommend to Council the makeup of the committee on community planning authorized at the annual meeting of the Institute in Winnipeg, and they were also asked to contact Mr. Bunnell and the Royal Architectural Institute of Canada, with a view to furthering the establishment of a community planning Institute.

Mr. Turnbull and Professor Flynn reported on the activities in Saint John and Halifax in connection with this work, and it was unanimously agreed that something should be done quickly to get engineers interested and active in the work of community planning. No report had yet been received from the committee appointed at the last meeting, so that no further action could be taken at this time.

Cooperative Agreement in Quebec—The general secretary reported on the number of applications which had been received under the terms of the recently completed cooperative agreement between the Institute and the Corporation of Professional Engineers of Quebec. One hundred and thirty-two applications had been received from members of the Corporation for membership in the Institute and 303 from members of the Institute for membership in the Corporation. Also under the terms of the agreement, 108 Students and Juniors of the Institute who were members of the Corporation had applied for transfer to the class of Member in the Institute.

Employment Conditions—The general secretary presented a report from R. E. Heartz, chairman of the Committee on Employment Conditions, in which the committee reaffirmed its report to council of December 16th, 1944, regarding support in the establishment of a collective bargaining agency in each province.

The general secretary explained that the Council of the Institute had declared its willingness to support the Federation and even aid it financially, provided its membership was open to all professional workers, whether they belonged to any organization or not.

The committee concluded its report by confirming its previously expressed opinion on the interpretation of the Minister's ruling, namely, that if engineers wished to bargain they may vote separately and therefore cannot be included with or outvoted by labour.

The general secretary read a letter from Alex. E. MacRae, chairman of the committee of fourteen, in which he discussed the possibility of the newly formed joint organization superseding the committee of fourteen on matters related to collective bargaining. He was of the opinion that it "would seem a rather inefficient and expensive procedure to have two committees duplicating their efforts in considering this particular matter, and particularly since they represented substantially the same groups."

Mr. MacRae was of the opinion that the position of the Institute with reference to the new council should be clarified. He suggested that to avoid unnecessary duplication of meetings and expenses perhaps the committee of fourteen "would be disposed to shift its responsibility to the Canadian Council."

There was a prolonged discussion, in which it was pointed out that as the committee of fourteen and its committee of three had been duly appointed to carry on the work of collective bargaining it seemed wise to ask the committee of three to continue to function along the lines for which it was created. It was pointed out that up to the present time the new council had had no authority from the fourteen societies to take over this work.

Professor Flynn inquired as to whether or not the committee of three had been set up only to handle the brief on collective bargaining, and Mr. Gunn stated that as far as the New Brunswick Association was concerned they would prefer to have the committee of three continue with whatever work there was on collective bargaining, representing the committee of fourteen.

Mr. Turnbull, referring to the comment of Mr. Gunn, made the following motion—That the Engineering Institute of Canada go on record as approving of the continuation of the committee of three as presently constituted to deal with collective bargaining. This motion was seconded by E. B. Martin and after further discussion was carried unanimously.

Engineers and the Design of Buildings—The general secretary stated that there was nothing further to report on this at the present time. The Institute had expressed its desire to cooperate, and a committee of six—three from the Institute and three from the Corporation of Professional Engineers of Quebec—had been appointed to consider the various matters as they come up, including the appeal in the Brian Perry case and the amendments to the Engineers' Act. There would not be much publicity in regard to the work of the committee, but the general secretary felt that the councillors should know that the matter was in competent hands and would be prosecuted as vigorously as possible.

Deterioration of Concrete Structures—The general secretary reported that Mr. R. B. Young had accepted the chairmanship of the interim committee to survey the situation and make recommendations as to what action, if any, the Institute should take. The committee hoped to meet shortly and would report to council in due course.

Committee on the Young Engineer—The general secretary reported that there had been many discussions as to a suitable person to replace Harry Bennett as chairman of the Committee on the Training and Welfare of the Young Engineer. One member who seems to be well qualified for the work has been approached, and he has been very much interested in the proposal. However, he is a very busy man and questioned whether he would be able to give the necessary time to the work of this important committee. He was giving the matter serious consideration, and would let council have his answer at an early date.

Montreal Branch Councillor—On the motion of Prof. Flynn, seconded by Mr. Russell, it was unanimously resolved that upon the recommendation of the Montreal branch executive Mr. C. A. Peachey be appointed councillor for the Montreal Branch until the next annual election to replace Mr. V. E. Gage who had recently been made Vice-President.

Alberta Association Representative on Council—It was noted that Mr. P. M. Sauder had been reappointed as the representative of the Association of Professional Engineers of Alberta on the Council of The Engineering Institute of Canada for the year 1945.

Committee on Professional Interests—The general secretary explained that when this item was put on the agenda it was expected that Mr. Stirling, the chairman of the committee, would be at the meeting. Unfortunately, although Mr. Stirling had been with the president in Halifax, he had had to return to Montreal before the Council meeting.

The president explained that he and the other officers had been fortunate in being able to meet with the councils of the associations in Nova Scotia and New Brunswick. He was very grateful to the associations for having made these meetings possible. He pointed out that the Institute was not represented on the new council which had been set up by certain other organizations in January, and that, if the meeting so desired, the matter could be discussed now even without a report from Mr. Stirling.

There was a general discussion in which the opinions of various provincial organizations were given and it was evident that there was still a substantial difference of opinion, particularly between professional engineering organizations, on the justification of the new body. Past-President McKiel believed that a definite protest should be made by the Institute and by the associations on the procedure taken at the meeting in Ottawa at which the decision was made to launch the new council.

Mr. Turnbull believed that any difference of opinion between the nine professional engineering organizations in Canada was likely to defeat some of the purposes which were in the interests of the profession. He did not favour the setting up of another organization although he believed that something might be gained by establishing a committee which could study the whole situation or be available for emergencies. He thought that the provincial professional organizations and the Institute would be quite capable of handling any matters which developed involving the profession of engineering.

After further discussion it was agreed that, inasmuch as there was no definite proposal before the meeting from the Committee on Professional Interests the matter should be left in abeyance until the next meeting of Council.

Technical Institutes—Further consideration was given to the advisability of establishing technical institutes across Canada. This subject had first been considered at a meeting of Council in February 1944, where, after lengthy discussion on a memorandum prepared by Dean C. R. Young, which had been circulated in advance, Council recorded its approval in the following resolution:

> That the Council of the Institute approves of the principle of establishing a number of technical institutes in Canada in accordance with the memorandum submitted by Dean C. R. Young . . . . and that the Institute request its branches in the various provinces to bring the need for some action in this matter to the attention of the provincial departments of education.

Every branch of the Institute had been circularized on the subject and in not one instance had a reply been received which did not favour the establishing of such institutes. In most instances the branches set up organizations which have actively pursued this subject ever since.

From the discussion at this latest meeting of Council it was evident that all present recognized the need for such technical Institutes, and on the motion of Mr. Lovett, seconded by Professor Flynn, it was unanimously resolved that Council reaffirm the opinion expressed at the February 1944 meeting.

Membership Committee—In the report of the Membership Committee presented to the annual meeting of council, certain recommendations had been made which were so far-reaching in their effect that it had been decided that the report should be printed in the *Journal* and distributed to the branches with a request for comment. In view of certain suggestions which have been made, Mr. Hall, the chairman of the committee, had been asked to revise the report somewhat, and the general secretary now presented the revised edition of the report, which he read to the meeting.

The report presents three definite recommendations for consideration: (1) automatic transfer of Student and Juniors—(2) possible elimination of the class of Junior—(3) appointment of an admissions committee.

The complete report will be printed in the *Journal* and distributed to branches and councillors, and while the recommendations are not now before council or the membership in final form, they are definitely in the minds of some of the members, and it has been thought that it would be helpful if this regional meeting of council had an opportunity of discussing the recommendations and making any suggestions or enquiries.

The general secretary outlined the situation in regard to the automatic transfer of Students to the class of Junior. In the case of university graduates this would present no difficulty. Most of the Students would be glad to be transferred in that way.

The elimination of the class of Junior would be a little more difficult to bring about. Some of the provincial Associations had already eliminated that classification.

Mr. Turnbull suggested that if the Junior classification was eliminated it might be desirable to have another classification, possibly called Associate Member, to which graduates could be elected until such time as they had had the required professional experience to qualify them for full membership in the Institute.

The general secretary pointed out that as the Associate Membership classification had been eliminated in 1940, if it were now revived the Institute would be going backwards instead of forward. Possibly what Mr. Turnbull had in mind was that we might suggest another name for the Junior classification.

Mr. Mitchell was of the opinion that there should be some classification which would cover the period during which young engineers would be expected to acquire the necessary experience between the time of graduation and when they can become full Members.

There was considerable discussion on the suggested elimination of the Junior classification, during which it was pointed out that if the Junior classification was eliminated it would not be necessary to discuss the question of automatic transfer from the class of Student to that of Junior. There would, however, appear to be some difficulty in providing for automatic transfer from the class of Student to that of Member.

As it was apparent that all the business could not be completed before lunch, the meeting was adjourned at 12.40 and reconvened at 1.40 p.m. with the president in the chair.

Continuing the discussion on the report of the Membership Committee, Council considered the desirability of appointing an Admissions Committee which would carefully review all applications and present them to Council in three lists, as follows:

i—Those which meet requirements
ii—Those which do not meet requirements
iii—Borderline cases.

Only those in Class—iii should be considered individually by Council, while those in Class—i and Class—ii should be considered as a whole unless some member of Council desires further information regarding any particular case.

The general secretary was very much in favour of this Admissions Committee, and wondered, if such a committee were appointed, if the list of applications that is now sent out to councillors every month could be eliminated. Would the councillors be willing to give up the prerogative that is theirs of voting on each individual application, and leave the decision to the committee? The list would be published in the *Journal* as usual, and the branches would still have the opportunity of going over the applications and making their recommendations.

Dean McKiel pointed out that if such a change in procedure were made, Council would still make the final decision on all applications when they were presented to a council meeting.

Following some further discussion, it was unanimously agreed that it was the general feeling of this meeting that the possibility of this new method of handling applications should be investigated. It was noted that after the report had been circulated and comments received from members and the branches, the committee would give the matter further consideration and would make a final report to Council.

Annual Meeting 1946—On the motion of Mr. Lovett, seconded by Mr. Turnbull, it was unanimously resolved that the invitation of the Montreal branch to hold the 1946 annual meeting in Montreal be accepted.

Conference of Undergraduates—At the last meeting of Council, consideration had been given to ways and means whereby the Institute could do more for the undergraduates. It has been suggested that it might be possible, at the time of the Institute annual meeting, to hold a conference of representatives of the engineering undergraduate societies of the various universities. The general secretary, acting on council's instructions, had communicated with the undergraduate societies and although to date response had been received from only two—Nova Scotia Technical College and University of New Brunswick, they were both very strongly in favour of the proposal. This progress report was accepted, and it was agreed that the general secretary should continue his negotiations.

Harry Bennett Memorial—At the annual meeting of Council held in February in Winnipeg, it had been decided that a special prize or fund should be established to commemorate the name and work of Harry F. Bennett, who had been chairman of the Institute's Committee on the Training and Welfare of the Young Engineer. Since then there had been some correspondence between officers of the Institute, but no definite recommendation had yet been made. It was suggested that it might be desirable to appoint a committee to gather ideas and see what form this memorial should take. Following some discussion, it was agreed that it should be left with the president, in consultation with other officers, to select a chairman for such a committee and to report back to the next meeting of Council.

Committee on the Engineer in the Civil Service—The general secretary read a letter regarding the new salary structure for professional, scientific and technical workers in the Civil Service, and suggesting that it might be possible to arrange for a further communication from the Engineering Institute to the Minister of Finance urging action on the improvement of salary conditions for engineers and professional workers in the Civil Service.

The general secretary presented a draft of a resolution which might be presented to the Minister. Following some discussion, on the motion of Mr. Lovett, seconded by Mr. Russell, it was unanimously resolved that the Institute's Committee on the Engineer in the Civil Service should be asked to take this matter up with the Minister of Labour.

American Society of Civil Engineers—Column Research Council—The general secretary read a letter from the chairman of an " organizing committee " of the A.S.C.E. inviting the Institute to participate in the formation of a proposed Column Research Council, and to name three representatives, to work with those from other organizations.

Following some further discussion, on the motion of Mr. Russell, seconded by Mr. Dickson, it was unanimously agreed that Mr. Pratley be approached and if he consents to act, that he, in consultation with the president, be asked to name the other two representatives.

City of Montreal—List of Electors—The general secretary pointed out that the Engineering Institute, as a property owner in the City of Montreal, may be entered on the voters' list and record its vote through a representative duly authorized by a resolution bearing the seal of the Institute. Such representative must be an officer or an employee of the Institute. To comply with this requirement, on the motion of Prof. A. E. Flynn, seconded by Mr. P. A. Lovett, it was unanimously resolved that L. Austin Wright, general secretary of The Engineering Institute of Canada, be appointed as the authorized representative of the Institute to vote on its behalf in the City of Montreal.

ELECTIONS AND TRANSFERS

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

Members

Brock, Thomas Leith, B.A.Sc., M.A.Sc. (Univ. of B.C.), i/c publications dept., Aluminum Laboratories Ltd., Kingston, Ont.
Brusset, John Albert, Mining Engr. (Nat. Sch. Mines, St. Etienne, France), vice-pres. and managing dir., West Canadian Collieries Ltd., Blairmore, Alta.
Callaghan, John Clinton, B.Sc. (McGill), works mgr., Canada Works, Steel Co. of Canada, Hamilton, Ont.
Diamond, Randolphe William, B.A.Sc. (Univ. of Toronto), gen. mgr., Consolidated Mining & Smelting Co., of Can. Ltd., Trail, B.C.
Dyck, Jacob Edward, B.Sc. (Mech.), (Univ. of Sask.), statistician, indus. engrg. dept., Aluminum Co. of Canada, Ltd., Arvida, Que.
Keay, John Alexander Dishington, gen. supt., Northern Construction Co., & J.W. Stewart Ltd., Vancouver, B.C.
Kellett, James Edward, B.Sc. (civil), (Univ. of Man.), senior asst. engr., Dept. of Public Works, Canada, Winnipeg, Man,
Kraft, Ferdinand, Diplom-Ingenieur & Doctor-Ingenieur, (Tech. Univ. of Darmstadt), i/c Kipawa Mill Research Dept.. Temiskaming Mill, Canadian International Paper Co., Temiskaming, Que.
Lambert, Lorne C., B.Sc. (mech.), (Queen's Univ.), dust control engr., Aluminum Co. of Canada, Ltd., Arvida, Que.
Lyall, James Russell, sr. designing dftsman., City of Vancouver, B.C.
Mason, George Meredith, B.A.Sc. (Univ. of Toronto), technical director, Arvida Works, Aluminum Co. of Canada, Ltd., Arvida, Que.
McGillivray, Donald Lachlan, Lt. Comdr. (E), B.Sc. (chem. Engr.), (Queen's Univ.), Staff of Director of Naval Engrg. Development, N.S.H.Q., Ottawa, Ont.
Monk, Angus Orr, B.Sc. (elec.), (Queen's Univ.), Lieut. Col. (T.S.O.I.) A.D.M.E., Arm't. Group, D.M.E., N.D.H.Q., Ottawa, Ont.
Nasmith, Douglas Forbes, B.A.Sc. (Univ. of Toronto), new products development engr., Aluminum Co. of Canada, Ltd., Arvida, Que.
Pawlikowski, Joseph, M.Sc. & Elec. Engr. (Inst. of Technology, St. Petersburg, Russia), D.Eng. (Institute of Technology, Warsaw, Poland), asst. professor, Ecole Polytechnique, Montreal, Que.
Scott, Ainsworth David, B.Eng. (civil), (McGill), office of the second asst. engr., Jamaica Government Railroad, Kingston, Jamaica.
Stewart, Robert Alexander, B.Sc. (Elec.), (Univ. of Man.), engr., City of Winnipeg Hydro Electric System, Winnipeg, Man.
Walsh, Geoffrey, Brigadier, C.B.E., D.S.O., B.Eng. (McGill), Chief Engineer, 1st Canadian Army Overseas.
Williams, Charles Reginald, vice-pres. & engr., Dickie Construction Co., Ltd., Toronto, Ont.
Youell, Leonard Lynde, B.A.Sc. (Univ. of Toronto), steam engr., engrg. div., development dept., The Solway Process Co., Hopewell, Va., U.S.A.

Juniors

Dupuis, John Joseph, (N.S.Tech), Elec. Sub-Lieut., R.C.N.V.R., St. Anselme, West Co. N.B.
Henderson, Ian Balfour, B.Sc. (civil), (Univ. of Man.), dftsman, Port Arthur Division, C.N.R., Winnipeg, Man.
Hobbs, David Haydn, B.Eng. (chem.), (McGill), Aluminum Co. of Canada, Ltd., Arvida, Que.
Honeywell, William Robert, B.Sc. (mining), (Queen's), asst. supervisor, fluoride plant, Aluminum Co. of Canada, Arvida, Que.
Jones, Robert John, B.Eng. (McGill), Lieut. (E), staff of Director of Ship Repairs, Royal Canadian Navy, N.S.H.Q., Ottawa, Ont.
King, James Malcolm, B.A.Sc. (Univ. of Toronto), metallurgist, Canadian General Electric Co., Peterborough, Ont.
Lewis, Ronald Wilfred James, B.A.Sc. (Univ. of Toronto), asst. supervisor, ore plant, Aluminum Co. of Canada, Ltd., Arvida, Que.
Marlatt, Charles Douglas, Elec. Sub. Lieut. (N.S. Tech.), R.C.N.V.R., Vancouver, B.C.
McKinnon, William John, B. Eng. (mech.), (McGill), junior engr., Dominion Oilcloth & Linoleum Co., Limited, Montreal, Que.
McQuire, Ralph D., B.Sc. (Queen's), chem. engr., supervisor of hydrate dept., Aluminum Co. of Canada, Ltd., Arvida, Que.
Miller, John Joseph, B.A.Sc. (Univ. of Toronto), tech. asst. to ore plant supt., Aluminum Co. of Canada, Ltd., Arvida, Que.
Ott, Thomas Edward, B.Sc. (C.E.), (Tri-State College, Indiana), stress engr., Fleet Aircraft Limited, Fort Erie, Ont.
Segalowitz, Kalman, B.C.E. (Coll. City of N.Y.), asst. supervisor, project staff, engrg. dept., Canadian Car & Foundry, Fort William, Ont.
Sick, Arthur Emil, (N.S. Tech.), Elec. Sub. Lieut. R.C.N.VR., H.M.C.S. Cornwallis, Victoria, B.C.
Simard, Laurent, B.A.Sc. (Laval), asst. supervisor, fluoride plant, Aluminum Co. of Canada, Ltd., Arvida, Que.
Tanner, Charles Jewell, B.Sc. (mining), (Queen's), asst. supervisor, Aluminum Co. of Canada, Ltd., Arvida, Que.

Transferred from the class of Junior to that of Member

Gordon, Harold Cowan Morton, B.Sc. (mining), (McGill), pres. & genl. mgr., Acadia Coal Co., Stellarton, N.S.
Ross, Arthur LeBreton, B.Eng. (McGill), plant engr., Pickering Works, Defence Industries Limited, Ajax, Ont.
Ross, Donald, B.Sc. (civil), (Univ. of Alta.), supervising inspector, Department of National Defence, Edmonton, Alta.

Transferred from the class of Student to that of Member

Bubbis, Nathan Simon, B.Sc. (C.E.), (Univ. of Man.), engr. water works & sewerage, Water Works, Winnipeg, Man.
Duncan, George Paterson, F/O., B.Sc. (C.E.), (Univ. of Man.), navigation instructor with R.C.A.F., Charlottetown, P.E.I.
MacDonald, Arthur Lamond, Major, B.Eng. (elec.), (N.S. Tech.), inspector of elec. engrg., Inspection Board of the United Kingdom and Canada, Ottawa, Ont.
Suthren, Joseph William, B.Eng. (mech.), (McGill), sr. supervisor of ammunition production. Canadian Industries Limited, Brownsburg, Que.
Tait, Eric, B.Eng. (civil), (McGill), structural design engr., G. Lorne Wiggs & Co., Montreal, Que.

Transferred from the class of Student to that of Junior

Blanchard, John Rust, B.Eng. (McGill), bleachery chemist, International Paper Co., Temiskaming, Que.
Cunningham, Robert Auld, B.Sc. (C.E.), (Queen's), asst. to res. engr., plant design & Mtce. work, Sorg Pulp Co., Port Mellon, B.C.
Duncan, Frederick Robert, Second Lieut., R.C.C.S., B.Eng. (elec.), (McGill), Officers' Mess, Vimy Barracks, Kingston. Ont.
Hughes, Gordon L., B.Sc. (mech.), (Univ. of Sask.), project engr., Frost & Wood Co., Limited, Smith's Falls, Ont.
Kane, Redmond John, Lieut. (SB) (E), R.C.N.V.R., B.Eng. (civil), (McGill), c/o Fleet Mail Office, Halifax, N.S.
Moseson, Stanley Gustav, B.Sc. (civil), (Univ. of Alta.), engr., Fred Mannix & Co., Ltd., Calgary, Alta.
Preboy, Joseph William, B.Sc. (mining), (Univ. of Alta.), asst. engr., Eldorado Mining & Refining Co., Port Radium, N.W.T.
Simpson, Jack Lloyd, Lieut., R.C.E., B.Sc. (civil), (Univ. of Alta.), engr. works officer, No. 13, E.S. & W. Coy., A-20, C.A.S.C., T.C., Red Deer, Alta.
Tivy, Robert Harrison, B.Sc. (E.E.), (Univ. of Man.), Elect. Lieut., R.C.N.V.R., Gyro Base Mtce. Officer, H.M.C.S., "Scotian", c/o F.M.O., Halifax, N.S.

Admitted as Students

Billinkoff, Louis, (Univ. of Man.), 335 Notre Dame Ave., Winnipeg, Man.
Cameron, Alwyn James, (Univ. of N.B.), 64 Portledge Ave., Moncton, N.B.
Carthew, Charles William, (Queen's Univ.), 551 Johnson St., Kingston, Ont.
Cyr, Reno Joseph, (Univ. of N.B.), Beaverbrook Residence, Fredericton, N.B.
Julson, Oliver Melvin, (Univ. of B.C.), 210 London St., Peterborough, Ont.
Landauer, Fred, (McGill Univ.), 5852 Sherbrooke St., West, Montreal, 28, Que.
McDougall, Roderick Lorne, (Univ. of Alta.), 11146 - 89th Ave., Edmonton, Alta.
Morgan, George Walter, (McGill Univ.), 17 Pagnuelo Ave., Outremont 8, Que.
Nicholls, John Henry, (Univ. of Alta.), 11019 - 84th Ave., Edmonton Alta.
Ritchie, Wendell Philip Jones, (Univ. of N.B.), 145 George St., Fredericton, N.B.
Roberts, William Raymond, (Queen's Univ.), 7 Richmond Ave., Kitchener, Ont.

Students at Mount Allison University

Black, Gerald MacLean, Campbellton, N.B.
Black, Raymond Ernest, Campbellton, N.B.
Bowser, Reginald Burton, Brunswick House, Sackville, N.B.
Clawson, Ernest Alexander, 227 Pownal St., Charlottetown, P.E.I.
Gidney, Samuel John, Mink Cove, N.S.

Glickman, Saul, 55 Charlotte St., Sydney, N.S.
Herdman, Robert, 1 Marcell Ave., Corner Brook, Newfoundland.
James, Willard Murray, Sunny Brae, West. Co., N.B.
Jost, Roland Marton, Yarmouth South, N.S.
MacDonald, William Earle, Beech St., Sydney Mines, N.S.
Maitland, Henry Crooks, Mt. Allison University, Sackville, N.B.
Pinsent, Ralph H., c/o Mrs. W. Greene, Sackville, N.B.
Wiles, Albert Vaughan, 35 Robie St., Amherst, N.S.
Wilson, William Maxwell, Brunswick House, Mt. Allison, Sackville, N.B.

Students at Laval University

Amyot, Bruneau, 23 Fraser St., Quebec, Que.
Babineau, Guy, 166 Garnier St., Quebec, Que.
Chabot, Yvon, c/o Laval University, Quebec, Que.
Fournier, Jean-Paul, 312 St. John St., Quebec, Que.
Grenier, Pierre, 142 Brown Ave., Quebec, Que.
Latouche, Marcel, 14 Ave. Royale, Courville, Quebec, Que.
Lavallée, Paul-Henri, Faculté des Sciences, Université Laval, Quebec, Que.
Ouellet, Aimé, 46 Sheppard Ave., Quebec, Que.
Perron, Gilles A., Ste. Marie, Beauce, Que.
Piche, Gerard Arthur, 67 Marguerite Bourgeoys Ave., Quebec, Que.
Santerre, Georges-Albert, 146 de Longueuil St., Quebec, Que.
Swift, Charles G., 101 Cascades Ave., Shawinigan Falls, Que.
Trudel, Lucien, 147 Blvd. de l'Entente, Quebec, Que.

Students at University of Toronto

Collings, Dana Buxton, 76 Willingdon Blvd., Toronto, Ont.
Craibbe, Harold Kenneth, 43 Eastwood Road, Toronto, Ont.
Horton, Graydon Thring, 3 Willcocks St., Toronto, Ont.
MacDonald, Donald Hugh, 101 Simcoe St., N., Oshawa, Ont.
Venton, Donald Maxwell, Drawer E, Bowmanville, Ont.

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 a basis of personal items in the *Journal*.

Dr. A. E. Cameron, M.E.I.C., Deputy Minister of Mines for Nova Scotia, was elected president of the Canadian Institute of Mining and Metallurgy at the annual meeting held in Quebec last month. A native of Ottawa, Dr. Cameron is a graduate of McGill University and was associated with the University of Alberta for 18 years. He served as councillor of The Engineering Institute of Canada last year, representing the Nova Scotia Association of Professional Engineers.

Wm. L. Campbell, M.E.I.C., who has been vice-president of the Brown Company, producers of purified cellulose, of Berlin, New Hampshire, is now in the Food Technology Department, Massachusetts Institute of Technology, at Cambridge, Mass.

Colonel H. R. Lynn, M.E.I.C., is at present technical and military adviser to the British Petroleum Warfare Department in the United States. Enlisting at the outbreak of the war with the Royal Canadian Engineers, commanding the 1st Battalion, R.C.E., overseas, he later, with the authority of General McNaughton, became associated in the design and development of flame weapons from the period of their conception to the present time. His field of operation is almost world wide. He returned from the Aleutian Islands some months ago and proceeded overseas on special work returning to America recently. Colonel Lynn is director of Lynn MacLeod Metallurgy Limited, Lynn MacLeod Engineering Limited, at Thetford Mines, Que., and other associated firms.

Douglas F. Hamelin, M.E.I.C., has resigned his position with the Department of Transport, Civil Aviation, at Lethbridge, Alta., to open a water supply company in that city to be known as Western Water Wells. Mr. Hamelin has been with the Department of Transport as a water supply engineer for four years in the development of water supply for the aerodromes throughout Manitoba, Saskatchewan and Alberta. This also included a preliminary investigation of water supply conditions within the Arctic Circle along the Mackenzie River. Previously he had been attached to the Prairie Farm Rehabilitation Administration staff in Regina for five years.

P. F. Peele, M.E.I.C.

P. F. Peele, M.E.I.C., is the newly elected chairman of the Calgary Branch of the Institute. Born at New Westminster, B.C., he graduated from the University of British Columbia with the degree of B.A.SC. in 1924. Upon graduation he became associated with the Canadian General Electric Company and has been with the company since that time. He was first employed in the testing department at Peterborough, Ont., later becoming sales engineer at Vancouver, B.C. In 1928 he was transferred to the Calgary office as sales engineer, which position he holds at the present time.

Mr. Peele joined the Institute as an Associate Member in 1924, transferring to Member in 1940. He was secretary-treasurer of the Calgary Branch in 1940-41 and served on the Executive last year.

J. Knox Davidson, M.E.I.C., has recently been admitted to active membership in the American Institute of Chemical Engineers.

Colonel J. P. Carrière, M.E.I.C., has been promoted from the rank of lieutenant-colonel and now holds the position of deputy chief engineer of the 1st Canadian Army in Europe.

C. H. Wright, M.E.I.C., maritime district manager of

Canadian General Electric Co. Ltd., has retired after 45 years service with the company. A graduate of McGill University—class of 1896—where he majored in science and engineering and secured his B.Sc. with honours, Mr. Wright spent his immediate post-graduation years in the service of Renfrew Electric Co., Royal Electric Co. and Terminal Railways, Montreal. He became associated with the Canadian General Electric Co. Ltd. in 1900, being engaged first in general installation work and later in the office. In 1906 he was transferred to the agency department—now the apparatus department—as sales engineer. He was appointed manager of the company's Ottawa office in 1907 and district manager at Halifax the following year.

Mr. Wright has always been keenly interested in Institute affairs. He represented the Halifax Branch on the Council in 1926, and is also a past-chairman of that Branch. He is a past-president of the Association of Professional Engineers of the Province of Nova Scotia.

C. V. Dunne, M.E.I.C., who has been resident engineer with the Naval Service, Works and Buildings, Department of National Defence at Sydney N.S., is now employed by the Standard Gravel & Surfacing Co. Ltd., contractors, at Calgary, Alta.

D. A. S. Laing, M.E.I.C., has been released from the R.C.A.F. with which he was serving as a flight-lieutenant. He has taken a position with the Phillips Electrical Works Limited at Brockville, Ont.

T. Stanley Glover, M.E.I.C., who has been serving with the Wartime Bureau of Technical Personnel for the past three years, has joined the staff of Ferres Advertising Service, Hamilton, Ont. A graduate of the University of Toronto, Mr. Glover has had 15 years experience in the direction of industrial advertising accounts. By agreement with the company with which he is presently associated, his services will be retained by the government in an honorary and advisory capacity.

C. H. Wright, M.E.I.C.

C. A. Morrison, M.E.I.C.

C. A. Morrison, M.E.I.C., succeeds C. H. Wright, M.E.I.C., as district manager at Halifax of the Canadian General Electric Co. Ltd. A native of Arthur, Ont., Mr. Morrison graduated from the University of Toronto in electrical engineering in 1927. After a period of service in the operating department of the Hydro-Electric Power Commission of Ontario and as a lecturer in the department of engineering physics at the University of Toronto, Mr. Morrison joined the Canadian General Electric organization in 1930. He entered the company's lighting service department, became lighting service engineer, Montreal, in 1931, and was appointed manager of the lamp division, Montreal, three years later. He remained in the latter position until his recent appointment.

W. Taylor-Bailey, M.E.I.C., has been elected a director of the Montreal Tramways Company. Mr. Taylor-Bailey, who is vice-president and general manager of Dominion Bridge Co. Limited, is also a director of Royal Bank of Canada, National Breweries Limited, Wabasso Cotton Co. Ltd., Dominion Bridge Co. Limited, Robt. Mitchell Co. Ltd., Fairchild Aircraft Ltd., Dominion Engineering Co. Ltd., National Drug and Chemical Co. of Canada Limited.

J. A. Wilson, M.E.I.C., Director of Air Services, Department of Transport, Ottawa, has been awarded the McKee Trans-Canada trophy for 1944. This trophy is awarded yearly for outstanding contributions to Canadian aviation. The selection committee of award for the trophy recommended Mr. Wilson for the award "in recognition of his long service, energetic support and whole hearted efforts in the development of civil aviation and for his untiring endeavours in behalf of the Royal Canadian Air Force in the selecting, surveying and constructing of aerodromes in the prosecution of Canada's war effort and the development of the British Commonwealth Air Training Plan".

C. A. Peachey, M.E.I.C., has been appointed councillor of the Institute to succeed E. V. Gage, M.E.I.C., who has become vice-president upon the resignation of E. B. Wardle. Born in London, England, Mr. Peachey graduated from the University of Toronto in 1927. Upon graduation he became assosiated with the Northern Electric Co. Limited in Montreal and has remained with the company since that time. His position now is that of works manager of the electronics division. He joined the Institute as an Associate Member in 1937 becoming a Member in 1940.

Neil B. Hutcheon, M.E.I.C.

Neil B. Hutcheon, M.E.I.C., has been elected chairman of the Saskatchewan Branch of the Institute. Born in Rosetown, Sask., he graduated from the University of Saskatchewan with the degrees of B.Sc. (Mech. Eng.) and M.Sc. in 1933 and 1935 respectively. He spent the two years after graduation in research work at the University of London, University College, London, Eng., returning in 1937 to the University of Saskatchewan, Saskatoon, as assistant professor in mechanical engineering, which position he still holds.

Lieutenant-Colonel W. A. Capelle, M.E.I.C., who is attached to the Headquarters Engineering Staff, 1st Canadian Army overseas, has recently been mentioned in dispatches for gallantry in action.

Philip S. Barratt, M.E.I.C., of the Consolidated Mining & Smelting Co. of Canada Ltd., has recently been transferred to Kimberley, B.C., as assistant superintendent of construction and maintenance for the Sullivan Mine. He was formerly engineering draughtsman at the plant at Trail, B.C.

Flight-Lieutenant G. H. Kimpton, M.E.I.C., has been released from the R.C.A.F. and has accepted a position with Stevenson and Kellogg Limited, management engineers, at Montreal, Que. Previous to his enlistment he was employed by the Oxygen Company of Canada.

W. J. Johnson, M.E.I.C., of the Department of Public Works of Canada at Ottawa, who has been on loan to the Winnipeg district office since August 1943, has returned to his work at headquarters.

Sub/Lieutenant C. B. Britnell, M.E.I.C., junior engineer in the Toronto district office of the Department of Public Works of Canada has been promoted to assistant engineer. He is at present on active service in the R.C.N.V.R. and upon his return will be attached to the Ottawa district office.

G. W. Griffin, M.E.I.C., has been appointed secretary-treasurer and registrar of the Association of Professional Engineers of New Brunswick. C. C. Kirby, M.E.I.C., will continue as secretary emeritus.

J. Knox Davidson, M.E.I.C., who recently returned from Australia to the Electric Reduction Co. of Canada Ltd., Buckingham, Que., where he was formerly assistant manager, has resigned from the company. He has accepted a position with Mainguys Limited of Montreal as development engineer.

R. L. Morrison, M.E.I.C., has recently taken a position with Fleet Aircraft at Fort Erie, Ont. He was formerly employed by Messrs. Airspeed (1934) Limited at Portsmouth, Eng., and for a time was on loan from the company to the Royal Air Force as technical adviser on the maintenance and operation of aircraft.

Cuthbert Poirier, M.E.I.C., has returned to the Department of Highways of the Province of Quebec. He is at present at Ville Marie, Que., in the capacity of division engineer for the counties of Temiscamingue and Rouyn-Noranda.

L. H. Wheaton, M.E.I.C, has completed his work with the Department of Munitions and Supply at Halifax and has returned to his former position as construction engineer with the Department of Highways and Public Works, Halifax, N.S.

H. A. Dixon, M.E.I.C., chief engineer of the Canadian National Railways, recently retired on pension. Mr. Dixon has been in the service of the C.N.R. for the past 42 years, joining the company as a draughtsman in 1903 and shortly afterwards becoming resident engineer. After serving in a supervisory capacity over engineering activities across the west he advanced to the position of chief engineer of the western lines of the railway. In 1940 he was appointed to chief engineer of operation for the system with headquarters in Montreal.

James McMillan, M.E.I.C., has been elected president of the Association of Professional Engineers of Alberta. He has been with the Calgary Power Company since 1927 becoming purchasing agent in 1931, supervising system substations and switching structures, which position he still holds. Mr. McMillan has been active in the Calgary Branch of the Institute and has served successively as secretary-treasurer, vice-chairman and chairman. Last year he was elected councillor of the Institute to represent the Branch. He has also served as councillor of the Association of which he is now president.

Norman B. Eagles, M.E.I.C., is at present employed as assistant city electrical engineer, Moncton, N.B. He was formerly engineering instructor, No. 35, E.F.T.S., R.A.F., Neepawa, Man.

J. W. Sanger, M.E.I.C., chief engineer, City of Winnipeg Hydro-Electric System, was elected national chairman of the Navy League of Canada Sea Cadet Committee, at the annual convention in Hamilton in March.

Nicholas L. Hartmann, M.E.I.C., has accepted a position with Canadair Limited, Cartierville, Que., in the tool and process department. He was formerly with Federal Aircraft Limited at Montreal.

Fernand Dugal, Jr.E.I.C., is now employed as shop engineer, tank arsenal, Montreal Locomotive Works, Montreal. He was previously manager of Jacques Cartier Industries Limited, Longueuil, Que.

Lieut. (E) H. U. Ross, Jr.E.I.C., is now at the Royal Canadian Naval College in British Columbia where he is instructing naval cadets in marine engineering. Before joining the R.C.N.V.R. he was employed with the Frobisher Exploration Company Limited at Ottawa.

E. Allan Harvey, Jr.E.I.C., formerly a flight-lieutenant in the R.C.A.F., has returned to civilian life and is now employed with Canadair Limited, Cartierville, Que., on installation design with respect to instruments and automatic pilot.

F/O Marcel Papineau, Jr.E.I.C., has been awarded the Distinguished Flying Cross. A graduate of the Ecole Polytechnique he was on the staff of the Noranda Mines Limited at Noranda, Que., until his enlistment in 1941.

Jacques Drouin, Jr.E.I.C., of Mathews Conveyer Company Limited, has been transferred from Port Hope, Ont., to Montreal, Que.

C. R. Jacobs, Jr.E.I.C., is at present employed by the Kuehne Chemical Company, Elizabeth, New Jersey, in the capacity of chemical engineer in charge of plant design and process changes. He was formerly located at the Belvedere, N.J., plant of the Hercules Powder Company as an inspector for the Inspection Board of the United Kingdom and Canada.

Elec./Lt. R. J. Beaudry, S.E.I.C., is now stationed at Naval Service Headquarters in Ottawa. He is engaged in electrical remote power control research and applications and also applications of radar to fire control. Lieutenant Beaudry has been in the R.C.N.V.R. since his graduation from Queen's University in 1944 and has just returned from service overseas.

D. H. Sands, S.E.I.C., is at present employed by the Northern Electric Company Limited at Montreal in the capacity of junior mechanical engineer.

W. B. Scott, S.E.I.C., has enlisted in the Canadian Army, R.C.E., and is at present stationed at Petawawa, Ont. Since his graduation from McGill University last year he had been employed in the engineering department of the Cornwall Division of Howard Smith Paper Mills, Limited.

Lieut.-Col. C. H. Drury, S.E.I.C., of Montreal, who is with the First Canadian Army overseas has been made an Officer in the Order of the British Empire.

André Aird, S.E.I.C., has recently been released from the R.C.A.F. and has accepted a position in the street lighting division, engineering department, City of Montreal.

(Canadian Army Overseas Photo)

Captain O. J. F. Rankin, S.E.I.C., is shown above in the fault control office of the signals control branch of the First Canadian Army headquarters overseas.

Obituaries

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

Lorne McKenzie Arkley, M.E.I.C., professor of mechanical engineering at Queen's University for 22 years, died at his home in Toronto, Ont., on March 19th, 1945.

Born at Leeds, Que., on August 31st, 1875, he graduated from McGill University with the degree of B.Sc. in 1900, receiving his M.Sc. in 1910. He spent two years with the Harbour Commissioners of Montreal as assistant mechanical superintendent and had five years engineering experience with such firms as E. I. Dupont & Company, Wilmington, Del., Wm. Wharton Jr. & Co., Philadelphia, Pa., and Westinghouse, Church, Kerr & Co. of New York. From 1905 until 1910 Professor Arkley was assistant professor of mechanical engineering at Swarthmore College, Pa., when his work included the establishing of a mechanical engineering course and the fitting up of a laboratory. He was also director of the night school of machine design of the Franklin Institute in Philadelphia. In 1911 he joined the staff of the University of Toronto as senior lecturer in mechanical engineering. He later became assistant professor of the department and remained with the University for nine years. In 1920 he was appointed professor of mechanical engineering at Queen's University, Kingston, which position he held until his retirement in 1942. Professor Arkley had done considerable work as consulting engineer in heating, ventilating, power plant design and operation, having written a number of papers on heating and ventilating problems.

Professor Arkley joined the Institute as a Student in 1899, transferring to Associate Member in 1906 and to Member in 1914.

F/O Bruce Sherwood Corbett, Jr.E.I.C., of the 62nd Squadron, R.A.F., India Command, was killed on active service on November 8th, 1944. Born at Montreal, Que., on April 12th, 1914, he received his preliminary education at Edmonton. He graduated from the University of Alberta with his B.Sc. in civil engineering in 1936, and in the following year received the degree of M.A.Sc. from the University of Toronto where he did postgraduate work in mine ventilation.

In 1938 he was employed as assistant to the ventilation engineer at the Frood Mine, International Nickel Company, at Copper Cliff, Ont., and in the following year became underground surveyor and stope engineer. In 1941 he enlisted in the Royal Canadian Air Force. After more than a year in the aeronautical division at Ottawa, he re-mustered to air-crew and received his wings at Uplands in 1943. After service with the Coastal Command in Ireland, F/O Corbett was posted to the Far East in June, 1944, where he was pilot of a Dakota air-craft carrying supplies to British troops in Burma. On November 8th he took off on a supply-dropping operation to British patrols in enemy territory when he was shot down by Japanese fighter planes and perished with all his crew.

F/O Corbett joined the Institute as a Student in 1936, transferring to Junior in 1941.

News of the Branches

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

BORDER CITIES BRANCH

F. J. Ryder, m.e.i.c. - *Secretary-Treasurer*
J. G. Hoba, Jr.e.i.c. - *Branch News Editor*

On January 9th, 1945, a meeting of the Branch was held at the Prince Edward Hotel, at which time R. C. Manning, chief engineer of the Canadian Institute of Steel Construction, gave a very interesting illustrated lecture on the **Canadian Universal Trestle,** in connection with the Bailey Bridge.

The regular meeting of the Branch was held on Friday, February 16th, at the Prince Edward Hotel, when J. L. McKeever, engineer in charge of the general engineering division of the engineering department, Canadian General Electric Company Limited, Peterborough, Ont., presented a paper entitled **The Amplidyne Machine.** Mr. McKeever's illustrated lecture showed the control and regulation of speed, voltage, current, and power over a wide range; the control of tension and torque to maintain product, and uniformity in winding, drawing, and other similar operations; acceleration and deceleration to vary the production of high-inertia machines. Mr. McKeever's lecture was well received, and great interest was shown by the excellent attendance at the meeting.

On Friday, March 16th, the regular meeting of the Branch was held at the Prince Edward Hotel, at which time W. D. Wollcott, presented a paper on some phases of arc welding. Mr. Wollcott has been associated with the Hydro-Electric Power Commission of Ontario as inspecting engineer for about 27 years, and in this capacity he has been in close contact with and a leader in the development of new welding and testing techniques. Mr. Wollcott, who supplemented his talk with slides, pointed out the various ways of checking welds and discussed very thoroughly the welding of ferrous materials.

CALGARY BRANCH

A. B. Geddes, m.e.i.c. - *Secretary-Treasurer*

The Calgary Branch of the Institute were guests of the Chemical Engineers of Canada at the Palliser Hotel on April 7th. Approximately 100 members attended the joint meeting under the combined chairmanship of P. F. Peele, branch chairman of the E.I.C. and R. Berkoff, branch secretary of the Chemical Engineers.

Two films were shown. The first, " From the Ground Up " showed operation at the Alberta Nitrogen Plant, and other similar plants. This film was very instructive and interesting. The manufacturing of TNT and the care with which this explosive was handled was brought out very finely in picture form. The filling of shells of all sizes, from the small anti-tank rifle shells to the depth charge used by the Navy, was gone into very thoroughly. The film also showed how these wartime plants can be of use in peace-time, and will be of great benefit to peace-time agriculture.

The second film " Synthetic Rubber," shown through the courtesy of the Goodyear Tire & Rubber Co. Ltd., was of great interest. Goodyear's accidental finding of the vulcanizing properties of natural rubber, and the similar properties of synthetic rubber in comparison with natural rubber were brought out. Self-sealing bullet proof gasoline tanks for use on aircraft were explained.

These two films were thoroughly enjoyed by 100 members present, and showed what great things chemistry is doing towards winning this war.

HAMILTON BRANCH

W. E. Brown, m.e.i.c. - *Secretary-Treasurer*
L. C. Sentance, m.e.i.c. - *Branch News Editor*

On Thursday, March 22nd, 1945, members and guests of the Hamilton Branch met at McMaster University on the occasion of the annual Students' and Juniors' Night.

Three papers were to have been presented in the annual Branch competition, but unfortunately, two of the participants were unable to be present, S. W. McKnight, on account of military duties and I. M. MacDonald, because of sickness.

Dr. A. Wingfield introduced the speaker of the evening and sole competitor for the Branch prize, T. J. Boyle, Jr.e.i.c., design engineer, Hamilton Bridge Company. Mr. Boyle chose for his subject **The Design of A Tubular Conveying Gallery.**

Mr. Boyle outlined the unusual problem with which he had been confronted in the design of an inclined tubular conveyor gallery, 8 ft. in diameter and made of 3/16 in. thick steel plate. The conveyor was to be continuous over one support with two spans of 91 and 77 ft. respectively and the effective thickness of material was to be considered as ⅛ in., 1/16 in. being the nominal corrosion allowance.

Mr. Boyle dealt in some detail with the main features of the problem, namely, structural strength required to withstand live and dead loads, wind loads, the effects of corrosion, elastic instability, maintenance and the effect of temperature variation.

With regard to a problem arising from the possibility of elastic instability, Mr. Boyle investigated thoroughly the possibilities of applying the results, both theoretical and experimental obtained by Dr. S. Timoshenko and Mr. L. H. Donnell of the University of Michigan. The experimental data previously mentioned have been obtained in the course of tests on simulated aircraft structures, and published prior to the outbreak of war. Mr. Boyle indicated that since the beginning of the war a very considerable amount of work has been done in connection with the problem of elastic instability in aircraft structures and that at the present time data exist which could be applied directly to the design of the tubular conveyor gallery. These data, however, for security reasons, have not yet been made generally available.

The problem presented by concentrated moments and shears at the centre support was solved by the use of circular reinforcing rings at this section. Adequate expansion joints were provided at both ends of the structure in order to accommodate temperature movements.

At the conclusion of his talk Mr. Boyle answered numerous questions.

An interesting sound picture entitled " Life-Line of the Nation " was presented through the courtesy of the Association of American Railroads. The film dealt with the response of the American Railroads to the heavy demands of wartime traffic.

J. T. Thwaites entertained the assemblage with interesting side lights on his recent trip to England.

N. Eager, branch chairman, presided. The attendance was 42.

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Friday, April 13th, marked the occasion of the annual joint meeting of the Toronto Section of the American Institute of Electrical Engineers, and the Hamilton Branch of the Institute. For the first time, the newly formed Hamilton sub-section of the American Institute of Electrical Engineers joined the other groups.

N. Eager, chairman of the Hamilton Branch of the Institute called the meeting to order. At the conclusion of his introductory remarks, Mr. Eager relinquished the chair in favour of A. W. Murdock, chairman of the Toronto Section A.I.E.E.

Mr. E. M. Coles, vice-president and director of engineering, Canadian Westinghouse Company, welcomed the gathering on behalf of the company, and introduced the speaker of the evening, Mr. F. K. Fischer.

Mr. Fischer, central station steam engineer, Westinghouse Electric and Manufacturing Company, Philadelphia, Pa., spoke on **Trends in Electric Power Generation.**

The speaker opened his discourse with a historical review of steam turbine development, from the original low pressure, low temperature, non-condensing turbine up to present day high pressure, high temperature condensing reheat and regenerative cycles. The increase in overall efficiency in a period of approximately forty years may be illustrated by the fact that latest modern stations are generating power at a rate of 1 k.w.h. for 10,000 b.t.u. while 30,000 b.t.u. per k.w.h. was common at the beginning of the century.

By use of slides, Mr Fischer outlined advantages to be gained by each of the following factors: increase in pressure, increase in temperature, regenerative feed water heating, reheating cycles, improved condensing apparatus.

The majority of machines now ordered in the United States are for 850 lb. and 900 deg. F. steam conditions. For topping turbines 1250 lb. and 950 deg. F. is the most popular condition. In this connection turbine manufacturers have, over the past two years, made impressive progress in standardization of ratings, and steam conditions.

Many advances have been made in hydrogen cooling of turbo-generators. All new and projected machines 20,000 kw. and over will employ high pressure (15 P.S.I.) hydrogen systems and many 15,000 kw. units will be similarly equipped.

Existing materials and heat cycles have practically limited the steam plant to its present development. Further increases in efficiency can be obtained but appear in general to require uneconomical refinements. The gas turbine has received much publicity over the last few years and the war has given great impetus to its development. At the present time this type of primemover constitutes a very real threat to the reciprocating engine, especially in the air. Mr. Fischer felt, however, that in its present stage of development it might find a place as standby or auxiliary to present steam control station equipment, but will not seriously compete for a number of years.

At the conclusion of his talk, Mr. Fischer answered numerous questions. Upon adjournment, refreshments were served to the 150 members and guests present.

MONTREAL BRANCH

L. A. Duchastel, m.e.i.c. - *Secretary-Treasurer*
Hyman Schwartz, s.e.i.c., Eli L. Ilovitch, s.e.i.c. - *Branch News Editors*

Dr. L. O. Grondahl, director of research and engineering, Union Switch and Signal Co., Swissvale, Pa., addressed the Montreal Branch on March 8th, 1945. The subject was **Train Communication.**

Train telephonic communication was developed as a means of increasing efficiency and economy of train operation and secondarily as a safety device. It facilitates exchange of information between both ends of a long train especially when visibility is poor. It is a particularly useful timesaver in switching in yards. It is also possible to converse between different trains up to 10 miles apart or between train and station up to 100 miles apart.

The inductive type of train communication, Dr. Grondahl stated, uses the track as ground and the electrical transmission lines alongside the track to close the circuit. The signal is sent out at 5700 cycles, travels along the electric wire and is picked up by the receiver. This system of contact requires about 500 watts for transmission and about 250 watts for reception of messages. In answering a question from the floor, the speaker mentioned that regular train generated power at 32 volts is used. This type of communication is favored over radio for three reasons (a) secret conversation is possible, (b) no licensing is required, (c) radio transmitting towers are not needed. Several American railroads have these systems in operation today and are planning extensions to this equipment.

D. J. MacDonald was in the chair. There were 125 members present.

* * *

"The manufacture of front line metal aircraft is the sheet metal worker's dream and the production man's headache," Mr. David Boyd, general manager of Victory Aircraft told the members of the Montreal Branch at the meeting held on March 22nd. Although Mr. Boyd's illustrated lecture dealt with the **Aircraft Industry** in general, many of his remarks concerned the Lancaster Bomber. The leading problems of the industry, from an engineering viewpoint, are: the manufacture of thousands of formed sheet metal parts; the draughting and fabrication of double curvature members; the assembly of these parts to accurate contours, especially external (aerodynamic) surfaces; and the maintenance of the proper relative position and interchangeability between large sub-assemblies, as fuselage, wing and tail sections, engines, gun turrets and control-surface units.

The tooling for aircraft production is complicated by the requirements which call for many thousands of different parts but only a few hundreds of each, and the constant stream of modifications which must be incorporated into the aircraft to keep it from becoming obsolete. Aircraft engineers have adopted all the methods used by other industries for forming metals and have developed some of their own, Mr. Boyd stated.

He then discussed in considerable detail the capabilities and limitations of the rubber hydro press and of the drop hammer. Assembly jigs and interchangeability gauges, up to twenty-five feet in length, are built on the "milk stool" principle, i.e., standing on three legs. They are structurally rigid and stable in themselves, are not affected by uneven floors, are accessible to workers, economical and easily transported.

The "drawings" for engine nacelles, fairings and other double curvature components are made from full scale loftings which are photographed. These photographs are then reproduced on the metal so that repetitive layouts are eliminated. Three dimensional templates obtained from solid mock-ups are extensively used.

Mr. Boyd made the lecture very stimulating by his keen wit and by his disclosure of many interesting facts of the Lancaster Bomber. He also discussed briefly the problems of labour and material supplies, the tremendous war expansion and post-war role of the industry.

Mr. Scheunert presided.

* * *

L. P. Cabana, superintendent and sanitary engineer, Division of Sanitation, Department of Health, City of Montreal, addressed the Montreal Branch on March 5th, 1945. Mr. Cabana, who is also professor at the Montreal Technical School, spoke on **Pollution Hazards in a Water Supply System.**

"The Department of Health wages an unending war against death brought about by water-borne diseases," said Mr. Cabana. All our city water supply comes from the St. Lawrence River, and though it appears to be crystal clear, it may contain deadly disease germs. Since all Montreal reservoirs are exposed to the atmosphere, and since there is then no protecting coat of ice, the maximum pollution of our water supply occurs in the summer. Samples of water are taken daily at different points in the city to make sure that this contamination is not a health hazard.

Cross connections are not permitted in Montreal, though dangerous situations may occur through connections with sprinkler systems, condensing units and during repair work on mains. Whenever possible where cross connections exist, double check valves are used, Mr. Cabana stated.

A blocked pipe may pollute the water supply by permitting water to be back-syphoned into the supply main. Fixtures should be designed, Mr. Cabana went on to say, so that no possible cross-connection may occur. All good modern plumbing fixtures have an integral air gap built in. That is, the overflow level is at least ½ inch below the fixture supply outlet. This advantage is lost however when a rubber hose is connected to the faucet and allowed to lie in the fixture because a dangerous connection then exists.

C. J. DesBaillets, was chairman of the meeting. There were 85 members present.

NIAGARA PENINSULA BRANCH

J. H. Ings, M.E.I.C. - - - *Secretary-Treasurer*
J. L. McDougall, M.E.I.C. - *Branch News Editor*

On March 1st, a Branch meeting was held at the Welland House, St. Catharines, to which all local members of the Association of Professional Engineers of Ontario were invited. The speaker was Lieut.-Col. T. M. Medland, Director of Public Relations for the Association and his subject was **The Association and Its Accomplishments.** He was introduced by Don Bracken, chairman of the Branch. The attendance was 82.

Col. Medland outlined the history of the Association and its growth to the present membership of 3,650 with an additional 2,500 student members. The changes in the Act that were made in 1937 helped promote this growth. This year the Association is pressing for certain additional amendments so that mining and chemical engineers will be included.

The speaker explained recent developments in collective bargaining. In 1944, P.C. 1003 made collective bargaining compulsory in all war industries. This is a Dominion ordinance and is effective for the duration of the war. However, six provinces have made the order applicable to all industry under provincial control. This development has posed a question for engineers: should they allow the labour unions to represent them or should engineers press for a separate bargaining agency of their own? At present, those registered engineers who are classed as employees have the power to set up their own bargaining agencies. In Ontario the Federation of Employee Professional Engineers and Assistants is being organized for this purpose.

Col. Medland mentioned the salary schedule that has been drawn up by the Association and also the Technical Service Council, which, besides acting as an employment agency, assists engineers to plan their professional careers.

There are various ways in which the individual engineer can help improve the status of the profession. He should use his seal on engineering plans and reports, should display his certificate in his office and should help promote the proper use of the term "Engineer."

At the conclusion of his address, Col. Medland answered a number of questions and explained the advantages of joining the Federation. The vote of thanks was proposed by P. Buss. Refreshments were served at the conclusion 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 a largely attended noon luncheon at the Chateau Laurier on March 21st, J. A. Wilson, director of air services, Department of Transport, and recent recipient of the Institute's Julian C. Smith Medal, was the speaker. He spoke on the **Development of Civil Aviation in Canada.**

Whatever may happen to the Alaska Highway or to the Canol project, the airway system to the Yukon and Alaska will surely never be wasted, was one prophecy made by Mr. Wilson. After the war in the Pacific is over it may be expected to assume an important place in the shortest air route to Japan. Hitherto such route has been by way of Honolulu but in the future the Alaska route will shorten this distance a great deal.

Another prophecy was that we may well look forward to the time when every youngster will want to learn to fly just as now he wants to learn to drive a car. With this there will come a tremendous expansion in aerodrome systems as well as in plane manufacture for civilian purposes. Not every aerodrome will need to be a million dollar one and there is no reason why every community in the country cannot have a landing strip for its local use, if only for small planes.

Regarding the domestic future of the plane Mr.

Wilson said that if the country is prosperous aviation will prosper. If not, progress will be slow. The Trans-Canada Airways are already doing a wonderful job and there is no reason why they should not grow. There is now trans-Atlantic service and in the future it is hoped to have trans-Pacific service and a route to the Caribbean area as well as others. Canada is naturally interested in that sphere when personnel and materials are available, Mr. Wilson remarked.

As for services into the northern portions of Canada these will depend largely upon the mining industry. Should this become prosperous enough the " ski and float " idea will give way to wheeled planes with adequately constructed aerodromes and regular services uninterrupted by change of seasons.

The speaker stated that it was difficult to hazard a guess as to what we might have in the way of civil aircraft for transportation a few years after the war. There might be, he said, from 200 to 300 large craft capable of carrying from 40 to 50 passengers each, a larger number of smaller planes and a considerable number of the much-disdained " puddle jumper." We now have the " know how " he said. Indeed the country might even look forward to supplying a small export market.

Mr. Wilson related briefly the events leading up to and including the recent Chicago conference on civil aviation at which representatives of 54 nations debated the subject of post-war aviation. The Canadian convention, he said, was easily the most complete and most thoroughly worked out at the conference and was taken as the basis of further discussion. The conference, although deadlocked on the freedoms of the air, succeeded in paving the way for a permanent convention which when finally put into effect will do much toward setting uniform standards for application in all countries of the world.

There is one thing, however, Mr. Wilson said, that should be guarded against and that is over-optimism. " There is so much optimism regarding post-war aviation, that there is a danger that we may wish to go ahead too rapidly." Reasonable progress only should be looked for. " Air power, like sea power," he said in conclusion, " for effective development, must be based on sound peace time uses."

* * *

At a noon luncheon on April 6th, the members of the Branch listened to an illustrated talk on **Rural Electrification** by Morris J. McHenry, of the Hydro-Electric Power Commission of Ontario. Mr. McHenry outlined some of the plans of the Commission toward the extension of this important service in Ontario after the war.

" The Commission will undertake the early completion, as soon as conditions imposed by the war permit, of sufficient rural power lines to serve all the farms in the province which can be practically brought within reach of its service," he said.

According to Mr. McHenry, the Commission proposes to reach the ultimate development in two stages. The first stage takes the form of a five-year plan to be carried out in the early post-war years. This plan calls for the construction, during the five-year period, of approximately 7,300 miles of distribution line with service equipment to supply 58,000 new customers, including 32,000 farmers.

The estimated cost of this construction programme is $22,500,000 of which 50 per cent will be provided by provincial subsidy. The Commission estimates that the execution of this plan will create a market for wiring and electrically operated equipment totalling approximately $40,000,000. With other necessary outlays the figure will reach the neighbourhood of $63,000,000 or an average of over $1,000,000 a month for five years.

The plan, it is estimated, will entail the installation of a large number of household appliances including: 18,800 electric ranges, 58,000 washing machines, 7,000 water heaters, 90,000 electric irons, 25,000 electric refrigerators, and 95,000 radios. For farm installations there will be specialized farm devices as 5,500 electric grain grinders, 3,100 milking machines, 7,500 water pumps, and 2,300 milk coolers.

A flourishing agriculture is the basis of Canadian prosperity, the speaker reminded his audience. Manufacturing, commerce, financial institutions, and industrial labour are all definitely interested in the question as to whether the farmer is to make a " go " of it or not. It is therefore, from every point of view, sound business to give the farmer the fullest possible support in his endeavours to improve his position productively and to better that home environment which provides such an important background to the efficient carrying out of his daily tasks.

Mr. McHenry illustrated his talk with lantern slides showing the growth of rural electrification up to the present and also some of the many uses to which it is put on the farm of today. The luncheon was largely attended. Norman Marr, chairman of the Branch, presided.

* * *

An illustrated address on the army design of vehicles was given at the noon luncheon on April 19th by R. E. Jamieson, Army Engineering Design Branch, Department of Munitions and Supply. Mr. Jamieson is professor of civil engineering, McGill University and has been on loan to the Dominion Government since 1941.

His address dealt with the design of army tanks, transport trucks, and other types of vehicles used by the army.

TORONTO BRANCH

S. H. de Jong, M.E.I.C. - *Secretary-Treasurer*
G. L. White, Affil.E.I.C. - *Branch News Editor*

On March 15th, 1945, the Toronto Branch and the American Society of Mechanical Engineers held a joint meeting in the Debates Room at Hart House.

The speaker of the evening, R. E. Jamieson, Director-General, Army Engineering Design Branch, Department of Munitions and Supply, was introduced by J. Hall. His subject was **Problems of Army Engineering.**

The Army Engineering Design Branch of the Department of Munitions and Supply was formed in 1941 for the purpose of ironing out many of the problems in the design of equipment, and to co-ordinate production with Canadian industry to assure the greatest production possible to meet the requirements of the army.

It was necessary to prepare basic specifications and to build test models. These models had to be tested before industry could proceed with production. Complex difficulties had to be solved for the manufacture of tanks, wheeled vehicles, signals, radar, and other army equipment by Canadian manufacturers.

Mr. Jamieson said there was much information regarding the development production programme which he was not free to divulge, and that a great many special features of the design of the equipment being produced could not be made public until after the war.

Canadian industry has contributed considerably to the design of tanks and other vehicles. At first, tanks were manufactured in accordance with British design. Slides were shown indicating many improvements in the later models now being manufactured.

The manufacture of pins for tank tracks was outlined by the speaker. Through the high degree of control in manufacture, and the constant testing, which is done by impact method, a great saving has resulted in the production, and charts shown illustrated that failure of pins has been reduced to a negligible proportion.

The use of armour plate for carrier hulls, and the development of welding armour plate, instead of riveting, was described. The Department of Munitions and Supply was the first to take the stand that welded hulls would not require to be stress relieved to avoid reduction in strength. The development of the method of welding this kind of steel is considered to be an outstanding achievement. One important feature of it is in the elimination of the hazard to occupants caused by flying rivets.

Wheeled vehicles form the greatest output of Canadian industry for the army. In the production of this class of equipment, attention is given to actual performance in battle and on the testing grounds in relation to calculated performance. The production of motor vehicles for arctic regions has required considerable investigation and development, to produce special batteries for starting in low temperatures. These investigations have also resulted in the design of equipment to automatically dilute the oil in the crank case with gasoline for low temperature starting.

A brief outline of the conservation programme and the use of synthetic rubber was discussed. Special specifications had to be prepared, and control of manufacture exercised, in order to gradually increase the amount of synthetic rubber used for production of tires. Accelerated tests were required before it was possible to proceed with production. Tires produced from synthetic rubber are now considered to be as good as tires produced before the supply of crude rubber was lost.

Very interesting slides were shown of the various classes of trucks used by the army, such as mobile laundry units, workshop lorries to house machine shops, trucks for carrying generator equipment, and troop carriers.

Professor E. A. Allcut and Professor C. F. Morrison thanked the speaker on behalf of the A.S.M.E. and the Institute respectively.

Library Notes

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

BOOK REVIEW

NEW ARCHITECTURE AND CITY PLANNING: a Symposium

Edited by Paul Zucker. New York, Philadelphia Library, c1944. 694 pp., illus. Reviewed by Stewart Young, M.E.I.C.

New Architecture and City Planning is a 700-page discussion by various writers—sociologists, editors, architects, a few engineers, and others—on subjects, some of which are either related to or deal directly with community planning. The book is not a text-book, but rather a source of general information and inspiration, especially to those persons engaged in the field of architecture.

The editor, Paul Zucker, has very ably arranged the contents in six sections under general headings, as follows: (1) Specific Building Types. (2) New Materials and New Construction Methods. (3) Housing. (4) City and Regional Planning. (5) The Problem of a New Monumentality. (6) Education. In the preamble, Mr. Zucker states the book to be an attempt at "traffic regulation of visions, guided by experience".

Of interest to the engineering profession are the nearly 200 pages in section IV, on City and Regional Planning, covering such subjects as: The Sociological Basis of City Planning, Highways—the Framework of the City and Regional Plan, the Influence of Public Utilities on City and Regional Planning. This section should be read by every town, city, county and highway engineer in Canada and by the senior executive officers of all public utilities.

ADDITIONS TO THE LIBRARY

TECHNICAL AND NON-TECHNICAL BOOKS

A.S.T.M. Standards, 1944; Part 3—Non-Metallic Materials —General:

Philadelphia, American Society for Testing Materials, c1945. 9½ x 6½ in.

Aeroplane Production Year Book and Manual (2):

M. M. Williamson and G. W. Williamson, editors. Lond., Paul Elek (Publishers), 1945. 5¾ x 8½ in. 40/–.

Aircraft Servicing Manual:

T. G. Preston and G. W. Williamson. Lond., Paul Elek (Publishers), 1945. 5½ x 8¾ in. 10/6.

Commercial Methods of Analysis:

Foster Dee Snell and Frank M. Biffen. New York, McGraw-Hill, 1944. 5½ x 8½ in. $6.00.

Testing of Weighing Equipment:

Ralph W. Smith. Wash., Government Printing Office, 1945. 5¼ x 7¾ in. 75c. (National Bureau of Standards Handbook H37).

Thesaurus of English Words and Phrases:
Authorized revision to 1941:

Peter Mark Roget. Toronto, Longmans, Green, 1945. 6 x 8 in. $1.80.

Whitaker's Almanack:

77th volume 1945. Lond., Whitaker, 1944. 5 x 7½ in. 10/–.

PROCEEDINGS, TRANSACTIONS, Etc.

American Society of Civil Engineers:

Transactions, Volume 109, 1944.

Connecticut Society of Civil Engineers Incorporated:

Annual Report, 60th, 1944.

Institution of Mechanical Engineers:

List of Members, Petition, Royal Charter, By-Laws, etc., 1944.

REPORTS, TECHNICAL BULLETINS, ETC.

Canada—Civil Service Commission:

Annual Report, 1944.

Canada—Dept. of Mines and Resources:

Annual Report, 1943-44.

Canada—Dept. of Transport:
Annual Report, 1943-44.

Canada—Wartime Prices and Trade Board:
Annual Report, 1944.

Canadian Broadcasting Corporation:
Annual Report, 1943-44.

Canadian Standards Association:
Interim and Emergency Revisions to Canadian Electrical Code, Part 1, 4th ed. (C22.1—1939). Supplement No. 1, 1942; Supplement No. 2, 1944.

Electrochemical Society:
Preprints—*887—10: Starting of Fluorescent Lamps.—87—11: Corrosion by Phenol at High Temperatures.—87—12: Corrosion of Steels in Marine Atmospheres and in Sea Water.—87—13: Comparative Effect of Carbon and Nitrogen on Intergranular Corrosion of 18/8 Stainless Steel.—87—14: Lowering of the Photoelectric Work Function of Zirconium, Titanium, Thorium and Similar Metals by Dissolved Gases.—87—15: Relationships Between Corrosion and Fouling of Copper-Nickel Alloys in Sea Water.—87—16: Metal Lusters: Their Characteristics and Limitations in Vacuum Tube Applications.—87—17: Some Factors Affecting the Precision in Polarographic Analysis.—87—18: Fluorescent Lamp Problems Challenge the Electrochemist.—87—19: An Apparatus for Measuring Corrosion.—87—20: Pipe Service Tests on Baltimore Water.*

Engineers' Council for Professional Development:
Annual Report, 12th, 1944.

Illinois University. Engineering Experiment Station:
Bulletin Series:—*No. 352: Impact on Railway Bridges, by Charles T. G. Looney.—No. 354: Viscosity of Gases at High Pressures, by Edward W. Comings, and others.—No. 355: Fuel Savings Resulting from Use of Insulation and Storm Windows, by Alonzo P. Kratz and Seichi Konzo.—No. 356: Heat Emission and Friction Heads of Hot-Water Radiators and Convectors, by Frederick E. Giesecke and Alonzo P. Kratz.*
Circular Series:—*No. 49: Drainage of Airports by W. W. Horner.*

Lethbridge Northern Irrigation District:
Annual Report and Financial Statement, 24th, 1944.

Montreal Tramways Company:
Annual Report, 1944.

United States. Dept. of the Interior. Bureau of Mines:
Technical Paper:—*664: Differential Thermal Analysis . . . by Sidney Speil and others.*

United States. Dept. of Commerce. National Bureau of Standards:
Building Materials and Structures. Report BMS103. Measurements of Heat Losses from Slab Floors, by Richard S. Dill and others.

United States. Office of War Mobilization and Reconversion:
Second Report . . ., April 1945.

PAMPHLETS

Astronomical Navigation Without Mathematics:
A. L. Mieville. New York, Macmillan, 1945.

Canada's Future Belongs to Free Canadians:
Montreal, Canadian Chamber of Commerce, 1945.

Co-operative Electrical Research:
Lond., British Electrical and Allied Industries Research Association, 1944.

Early Beginnings of Transportation in Colorado—A Pilgrim Address:
Henry Swan. Princeton University Press, 1944.

Engineering and Research in the U.S. Navy:
Harold G. Bowen. Princeton University Press, 1944.

First Reports in the British Post-War Building Study:
Reprinted from Industrial Standardization, March 1945.

How to Run a Lathe, Volume 1, 43rd ed.:
Care and Operation of a Screw-Cutting Lathe: (In French and English).
J. J. O'Brien and M. W. O'Brien. South Bend, South Bend Lathe Works, 1944.

Let's Consider Jobs; Electric Utility Industry:
Group Discussion Series No. 4—(20). Ottawa, Canadian Legion Educational Services, 1945.

Quarter Century of Progress in the Canadian Section, A.W.W.A.; 1920-1945:
Ross L. Dobbin. Peterborough, Canadian Section, American Water Works Association, 1945.

General Motors Co-operative Training Programs, 1944-45. Registration Manual:
General Motors Institute, 1944.

Short Peening and the Fatigue of Metals:
H. F. Moore. Mishawaka, Ind., American Foundry Equipment Co., 1945.

Simplified Analysis of Hollow Beams with Longitudinal Webs Subjected to Torsional Loads:
Eryk Kosko. (Reprinted from Journal of Aeronautical Sciences January, 1945).

BOOK NOTES

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.

ADSORPTION

By C. L. Mantell. McGraw-Hill Book Co., New York and London, 1945. 386 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $4.50.

Practice, rather than theory, is the keynote of this new approach to the subject of adsorption written from the viewpoint of industrial procedure, the designing engineer, and the operator of equipment. Emphasizing its unit operation aspects, the book covers adsorption in industry and discusses such varied fields as refining operations, air conditioning, elimination of toxic materials, etc. Fuller's earth, activated clays, activated carbons, silica gel, aluminum oxide base materials, and other commercial adsorbents are dealt with.

AIRCRAFT VIBRATION AND FLUTTER

By C. R. Freberg and E. N. Kemler. John Wiley & Sons, New York; Chapman & Hall, London, 1944. 214 pp., diagrs., charts, tables, 8½ x 5½ in., cloth, $3.00.

In non-technical language, with a minimum of mathematics, this book explains the fundamentals and general phases of vibration and flutter affecting both stationary wing and rotating wing aircraft. The material is arranged to give practical aid in problems of aircraft testing and analysis. Engine isolation and soundproofing are dealt with in an early chapter. There is a bibliography.

AIRCRAFT YEAR BOOK for 1944, 26th Annual Edition

Edited by H. Mingos. Lanciar Publishers, 10 Rockefeller Plaza, New York, 1944. 727 pp., illus., diagrs., tables, 9 x 5¼ in., cloth, $6.00.

The new edition of this annual publication of the Aeronautical Chamber of Commerce of America reviews the events of the year, both in military and civil aviation, and the work of American manufacturers. Associations, government bureaus and other organizations interested in aviation are listed, with their officers. Statistics, records, etc., are tabulated.

ANALYSIS OF DRILL-JIG DESIGN

By J. I. Karash. McGraw-Hill Book Co., New York and London, 1944. 333 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $3.00.

The author presents a systematic approach to the problems of tool design, using drill jigs as a specific case study and outlining fundamental principles that apply in varied degree to all tool design problems. The process of design is analyzed into a clear-cut procedure, stressing the essential decisions, their proper sequence, and basis of fact for arriving at decisions. Specific examples are used throughout.

COMING AIR AGE

By R. M. Cleveland and L. E. Neville. McGraw-Hill Book Co., Whittlesey House Dept., New York and London, 1944. 359 pp., illus., tables, 8¼ x 5½ in., cloth, $2.75.

This book presents a logical outline of the new developments and problems that can be expected in the aviation world of tomorrow. Beginning with a discussion of the probable status, both technical and financial, of the industry when the war ends, the book goes on to discuss the geography of the air, freedom of the air, airlines, and sky freighting. The giant plane, helicopter, rocket ship, and new power sources, as well as the more typical craft of the predictable future are described. The question of air-age education is considered from both a national and international viewpoint.

ENGINEERING FOR DAMS, 3 Vols.

By W. P. Creager, J. D. Justin and J. Hinds. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 929 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $16.50.

This work aims to provide a compendium of modern practice in dam building that is sufficiently detailed to meet the needs of engineers well as students. Volume one discusses general design, including the investigation of dam sites, choice of type, foundation preparation and protection, hydraulic model studies, flood flows and spillways. Volume two deals with concrete dams of all types. Volume three treats of earth, rock-fill, steel and timber dams. Bibliographies occur throughout the work. The authors have had the assistance of a number of other well-known hydraulic engineers.

HANDBOOK OF MINERAL DRESSING, Ores and Industrial Minerals

By A. F. Taggart. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 1,939 pp., diagrs., charts, tables, 8½ x 5½ in., cloth, $15.00.

This is the successor to the author's well-known "Handbook of Ore Dressing". It deals with the processes, largely mechanical, involved in the concentration of metalliferous ores and the benefication of industrial minerals. The work has been thoroughly revised and to a large extent rewritten. New sections have been added, and the whole work brought up to date. The book is an important addition to engineering handbooks.

HIGH-FREQUENCY INDUCTION HEATING

By F. W. Curtis. McGraw-Hill Book Co., New York and London, 1944. 235 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $2.75.

The industrial appl cat ons of induction heating are explained. Heating procedures and principles and the constructional features of industrial heating coils are described in detail, and fixture design and process handling equipment are outlined broadly. The book is intended to simplify the application of induction heating and to assist in the installation of equipment for specific operations.

MODERN SYNTHETIC RUBBERS

By H. Barron. 2 ed. revised and enlarged. D. Van Nostrand Co., New York, 1944. 355 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, $6.50.

The primary purpose of this book, which appeared in 1942, was to awaken Great Britain to the growing importance of synthetic rubber. It presented a systematic account of the new material, considered historically, scientifically and technically, as revealed in the literature. The present edition has been thoroughly revised to take account of developments since 1942, especially those resulting from work in the United States.

PERSONNEL RELATIONS

By J. E. Walters. Ronald Press Co., New York, 1945. 547 pp. charts, tables, 9½ x 6 in., cloth, $4.50.

This book endeavors to set forth both principles and practice in the field of present-day personnel relations. It includes the varying phases of personnel relations as they are determined and influenced by workers in labor unions; managements; the government; individual employees; labor-management co-operation; and personnel relations techniques and procedures. The author's further intent is to present personnel relations from positive democratic viewpoints of those actively concerned. The material is based on the author's extensive personal experience plus outside collaboration.

PIONEERING THE HELICOPTER

By C. L. Morris. McGraw-Hill Book Co.; New York and London, 1945. 161 pp., illus., diagrs., maps, 8¼ x 5½ in., cloth, $2.75.

The author became Chief Test Pilot for Sikorsky Aircraft in 1941 and held that position during the next three years. His story is an interesting, personal one, showing the steps by which success has been reached and discussing future possibilities. A readable account, which will correct various misconceptions.

PORT TERMINAL OPERATION

By E. H. Lederer. Cornell Maritime Press, New York, 1945. 430 pp., illus., diagrs., charts, tables, 9¼ x 6 in., fabrikoid, $5.00.

Taken from practical experience, the material presented in this book contains a large amount of exact information useful for any one actively engaged in the field. It describes the latest equipment, its use and maintenance, administration and paper work, railroad and warehouse facilities, stowage methods and stowage factors, stevedoring, lighterage operation and harbor craft. The book was prepared as a training manual for both peacetime and wartime civilian use.

PRODUCTION ENGINEERING IN THE AIRCRAFT INDUSTRY

By A. B. Berghell. McGraw-Hill Book Co., New York and London, 1944. 307 pp., diagrs., charts, tables, 9 x 5¾ in., cloth, $3.00.

A practical text embodying principles, illustrated by specific cases, questions, and answers, for the solution of common problems encountered in the aircraft industry. The author explains the application of principles of estimating new contract costs, budgeting and scheduling direct labor hours, controlling work in process through the use of time standards, work simplification, material saving, statistical and graphical reports, etc. An appendix contains a glossary and many useful data tables.

PRODUCTION-LINE TECHNIQUE

By R. Muther, with a foreword by E. H. Schell. McGraw-Hill Book Co., New York and London, 1944. 320 pp., illus., diagrs., charts, tables, 9 x 5¾ in., cloth, $3.50.

This book is designed for industrial executives who are considering the application of production-line methods to their manufacturing operations. Particularly, its purpose is to present the possibilities of the production line in the medium-sized plant. which heretofore has operated on a job-lot basis. Based on first-hand field investigations of current practices, this book explains the fundamentals of production lines, compares them with job-lot manufacture and shows how production lines are set up and operated. Their advantages and limitations are pointed out.

REPORT OF THE URBAN PLANNING CONFERENCES at Evergreen House, 1943, under the auspices of The Johns Hopkins University

Publ. by Johns Hopkins Press, Baltimore, Md., 1944. 245 pp., illus., maps, diagrs., 9½ x 6 in., cloth, $2.75.

This interesting volume presents the results of a series of six conferences held under the auspices of Johns Hopkins University and participated in by many experts. The subjects discussed were the basic directives in urban planning, geographic, population and economic; transportation, railroads, highways, air transportation; housing, health, recreation and welfare; the governmental framework and other processes of urban planning.

STEAM BOILER YEARBOOK AND MANUAL (III edit.)

Edited by S. D. Scorer. Payl Elek, Ltd., Africa House, Kingsway, London, W.C.2., 1945. 569 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, 30s.

The first part of this annual publication presents a descriptive review of current British practice in steam-boiler engineering. The second part contains abridgments of the principal steam-boiler papers published during the past year, grouped under the following five headings: fuel utilization; combustion appliance developments; feed water and steam problems; fire side problems; modern practice and developments. A book review section has been added to Part I in the present edition.

PROPOSED NEW STANDARDS

CANADIAN STANDARDS ASSOCIATION: CANADIAN ELECTRICAL CODE, Pt. IV

Proposed new CSA Standards dealing with suppression of Radio Interference.

Preparatory committees of the Canadian Electrical Code, Part IV, are now completing a series of new C.S.A. tentative standards dealing with tolerable limits of radio interference and methods of measurement.

It is anticipated that the various provinces will, in the near future, consider the adoption of C.E. Code, Part IV, in a similar manner to that in which they dealt with C.E. Code, Parts I and II.

The following tentative standards are expected to be published in the near future and will be useful to Canadian manufacturers in designing and producing "interference free" electrical apparatus. These standards are similar to those of foreign countries which now have or are contemplating legislation to prohibit interference. The implications of this action, in relation to foreign trade, will be obvious to Canadian manufacturers.

(*Continued on page 338*)

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

April 30th, 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 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 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 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

BEGLEY—WILLIAM MacDONALD, of Toronto, Ont. Born at Windsor, Ont., Jan. 10th, 1912. Educ.: B.Sc., Detroit Inst. Tech., 1937; 1937-40, student course, Can. Gen. Elec. Co., Peterboro, Ont.; 1940-41 mech. & elec. design Amalgamated Elec. Co., Toronto; 1941-42, elec. mtce., Research Enterprises Ltd., Toronto; 1942 to date, group supervisor of equipt. & elec. group of aircraft engrg. dept., Massey-Harris, Weston, Ont.
References: M. Powell, A. L. Malby, J. Clark Keith, H. R. Sills.

BROOKS—JOHN ALFRED, of Shawinigan Falls, Que. Born at Sarnia, Ont., Aug. 9th, 1920. Educ.: B.Sc., Queen's Univ., 1942. 1942-43, chemist, Defence Industries Limited, Nobel, Ont.; 1943-45, shift supervisor, and at present supervisor of personnel & operations, Canadian Resins & Chemicals, Shawinigan Falls, Que.
References: C. G. de Tonnancour, D. S. Ellis, A. L. Clark, C. Morris, R. A. Low.

BURGESS—JOHN ADAM, of Outremont, Que. Born at Aboyne, Aberdeenshire, Scot., March 24th, 1889. Educ.: Robt. Gordon's Tech. Coll., Aberdeen, (evening classes), 1908-1911; day courses at same college in engrg., subjects leading to B.O.T. engrg. surveyorship exainations. Ap'ticeship & two years work in shops, Strath Engrg. Works, Aberdeen, 1906-15; engr. on steamships from junior to chief engr., 1915-22; instructor in marine engrg. subjects at N.S. Tech. Coll., Hlf., 1924-25; asst. to supt. of Cdn. Gov. Merchant Marine, 1926-28; struct. dftsman., St. John Drydock & Shipbuilding Co., St. John, N.B., 1929-31; foreman on constrn. & later boiler house foreman, Shell Oil Refinery, Mtl. East, 1932-34; asst. to mech. supt., 1934-35, and 1936 to date supt. i/c of engrg. services, W. C. Macdonald Inc., tobacco mfrs.
References: E. V. Gage, G. H. Gillett, G. K. McDougall, E. E. Orlando, A. D. Ross.

CALDWELL—GEORGE ALEXANDER, of Toronto, Ont. Born at Glasgow, Scot., Jul. 8th, 1901. Educ.: B.Sc. (eng.), Glasgow Univ., 1925; dipl. Royal Tech. Coll., Glasgow, 1925; R.P.E., Ontario, 1938. 1915-22, ap'ticeship, drawing & design, D. Stewart & Co., Glasgow, Scotland; 1925-39, asst. to Foreign Relations engr., Bell Telephone Co. of Can.; 1930-34, Foreign Wire Relations engr., Western area; 1934-37, transmission practices engr.; 1938-42, toll line engr., Western area; 1942 to date, ecxhange plant engr., Western area, Bell Telephone Co. of Can.
References: J. L. Clarke, W. H. Slinn, J. E. McKinney, R. H. Spriggs, W. G. Lloyd, G. A. Wallace, D. J. McDonald, W. P. Dobson, D. G. Geiger.

CROTHERS—DONALD COVERDALE, of Montreal Que. Born at Ottawa, Ont., Oct. 17th, 1910. Educ.: B.Sc., Queen's Univ., 1937. (summers), 1934-35, working in shops; 1937-38, service engr., Toronto; 1938-42, application engr., Vancouver; 1942-43, engr., compressor div., Montreal; 1943 to date, mgr., compressor div., Montreal, Canadian Ingersoll-Rand Co., Ltd.
References: A. S. Gentles, W. O. C. Scott, C. N. Danks, D. S. Ellis, E. T. Harbert.

FODOR—NICHOLAS, of Sarnia, Ont. Born at Balassagyarmat, Hungary, Apr. 12th, 1903. Educ.: B.A.Sc., Univ. of Prague, 1924; R.P.E., Ont., 1945; 1924-27, asst. to chief engr. on mfr. of switch gears & elec. H.T. equipt, Carl Engel Co., Budapest, Hungary; 1927-37, consltg. & contract'g. engr. in design & constrn. of steam power plants in Hungary; 1939-42, mech. engr., Goodyear Tire & Rubber Co. of Can., Toronto; 1942-43, engr. i/c of mech. & elec. installn.; 1943 to date i/c engr. dept., Canadian Synthetic Rubber Ltd., Sarnia, Ont.
References: K. R. Rybka, M. Lazier, E. W. Dill, L. Trudel.

FRANKLIN—RAYMOND WILLIAM, of Winnipeg, Man. Born at St. Boniface, Man., Sept. 2nd, 1921. Educ.: B.Sc. (civil), Univ. of Man., 1942; 1 yr. post-grad. study. 1942, jr. engr., mtce. dept. Defence Industries Ltd., Transcona, Man.; 1942-43, demonstrator in civil engrg., Univ. of Man.; 1943-44, Lieut., R.C.E. At present F/O (WAG), R.C.A.F.
References: E. P. Fetherstonhaugh, A. E. Macdonald, G. H. Herriot, N. M. Hall, W. F. Riddell.

HEUPEDEN—MARTEN, of Montreal, Que. Born at Kassel, Germany, Aug. 31st, 1919. Educ.: Royal Tech. Coll., Salford, Eng., 1937-38; University School of Arch., Manchester, Eng., 1938-40. 1942, architect'l. dftsman, Machinery Service, Ltd., Montreal, and Ross & Macdonald, architects, Montreal; 1942 to date, struct'l. dftsman., A. Surveyer & Co., consit'g. engrs., Montreal.
References: A. Surveyer, E. Nenniger, J. G. Chenevert, W. A. Janelle, E. W. J. Turcke, E. Deslauriers.

JOHNSON—DOUGLAS SANDERSON, of MacLeod, Alta. Born at Medicine Hat, Alta., Mar. 17th, 1918. Educ.: Univ. of Sask., 1938-40. With the Dept. of Transport of Can., on airport constrn. as follows: 1940-41, chainman; 1941-43, instru'mn. & asst. to res. engr.; 1943-44, preliminary survey for airport sites; 1944 to date, res. engr., Embarras Airport, Alta.
References: A. L. H. Somerville, T. Miard, T. O. Nuemann, G. Knutsen.

MACDONALD—ALLAN GEORGE, of Halifax, N.S. Born at Calgary, Alta., Feb. 13th, 1915. Educ.: 1944 graduate of special electrical course at the N.S. Tech. Coll. given to selected personnel in the Navy qualifiyng them for commissioned officer. (Course approved by Council as meeting requirements for Junior); 1933-40; research asst., Consolidated Mining & Smelting Co., Trail, B.C.; with the R.C. Navy as follows: 1940-41, foreman instrument dept.; 1941-44, artificer; at present, Elect. Sub. Lt.
References: F. H. Sexton, G. H. Burchill, J. J. Smith, J. Dean, W. H. G. Roger.

McDERMOTT—ARTHUR GREGORY PAUL, of Saint John, N.B. Born at Saint John, N.B., June 18th, 1920. Prod. engr., elec. div., Northern Elec. Co., Ltd., Mtl.; 1944 to date, asst. constrn. engr., N.B. Telephone Co., Saint John, N.B.
References: A. F. Baird, R. M. Richardson, A. A. Turnbull, C. D. Murdoch, R. Raynes Ford.

McNALLY—PATRICK JESSETT, of 5850 Coolbrook Avenue, Montreal. Born at Bartonville, Ont., Jan. 6th, 1915. Educ.: B.Sc., Queen's Univ., 1939. 1939-42, shift boss, East Malartic, Mines; 1942-44 constrn. Engr., Dominion Construction Corp. 1944 to date, constrn. engr. E. G. M. Cape & Co., Montreal.
References: C. K. McLeod, J. B. Stirling, E. G. M. Cape, E. H. Beck, C. E. Hogarth.

MORTON—KENNETH WILLIAM, of New Westminster, B. C. Born at Perth, Scotland, Nov. 12th, 1888. Educ.: University College, Dundee, Scot., 1906-08; passed Inst. C.E. exam. (assoc. member), 1908. 1908-11, C.E. ap'ticeship. in Scotland; with Dept. of Public Works of Canada, as follows; 1912-33, asst. engr., New West., B.C., except for overseas service, 1917-19; 1925-39, sr. asst. engr.; 1938 to date, dist. engr., B.C., Yukon District.
References: K. M. Cameron, F. G. Goodspeed, R. Blais, C. E. Webb, W. G. Swan.

NEIL—JAMES PHILIP, of Ottawa, Ont. Born at Wolverhampton, Eng., Mar. 5th, 1911. Educ.: Central Tech. School, Toronto, 1930-32; Univ. of Tor., extension courses, 1927-29. lab. asst., on testing Radio Valve Co.; 1935-37, i/c (Toronto Police Radio System), installn., operation & mtce.; 1939-40, free-lance commercial & press photography; insurance and property management; 1940-44, examiner with Inspection Board of the U.K. & Canada; at present, Elect. Sub. Lieut., Directorate of Elec. Supply R.C.N.V.R., Ottawa.
References: F. W. R. Angus, A. D. Turnbull, J. E. McKinney, A. R. Gourlay.

PEEBLES—ANDREW AUREBON, of Calgary, Alta. Born at Albury, England, Jan. 13th, 1886. Educ.: University College, London, 2nd & 3rd yr., mech. engr., 1907-09; 1902-04, ap'ticeship. in fitting shop, Jas. Howden & Co., Ltd., Glasgow, Scot.; 1904-07, pupil, R. Motion & Co., constult'g. engrs. & power specialists, Glasgow; 1909-12, asst. engr., J. Glover & Co., consult'g. engrs. & assessors; 1912-14, editor, Western Canada Contractor, Winnipeg; 1914-18, on active service in Canadian Forces; 1919-22, sr. instructor, steam & mech. engrg., Int. Corr. Schools, London, Eng.; 1923-25, Tech. Educational Officer, R.A.F.; 1930-41, chief instructor, Dept. of Aeronautics, Prov. Institute of Technology & Art, Calgary; 1941-44, aero. engrg. officer, R.C.A.F.; 1944 to date, chief instructor, Dept. Aeronautics, Prov. Institute of Technology & Art, Calgary.

References: A. Higgins, F. N. Rhodes, J. H. Ross, J. B. de Hart, T. B. Williams.

SANDERSON—DAVID REYNOLDS, of Toronto, Ont. Born at Toronto, Ont., Dec. 25th, 1922. Educ.: B.A.Sc., Univ. of Tor., 1944. (summer), 1942, year, detailling, reinforcing, steel, Dominion Structural Steel Ltd.; 1943, field engr., plant constrn. on Polymer Corporation, Sarnia, Ont. 1944 to date, drafting, detailling, designing, reinforced concrete & steel structures with Gordon Wallace, consult'g. engr., Toronto.

References: G. L. Wallace, C. D. Carruthers, N. D. Wagner, R. F. Legget, S. H. deJong.

SAUDER—FREDERICK JAMES, of Amherst, N.S. Born at Calgary, Alta., June 26th, 1916. Educ.: B. Eng. (mech.), McGill Univ., 1940. With Canadian Car & Foundry Co., Ltd., as follows: (summers), 1938-39-40, machinist, tool maker helper, aircraft insptr. Mtl.; 1941-42, asst. shop. insprt., Amherst plant; 1942-43, chief insptr.; 1943 to date, asst. work supt., Amherst, N.S.

References: P. M. Sauder, L. A. Wright, R. N. Dobson, D. Boyd, R. deL. French, G. L. Dickson.

TAYLOR—NEWTON PHILIP, of Montreal West, Que. Born at Rome, Pa., June 29th, 1902. Educ.: Mech. Engr., Rensselaer Poly. Inst., 1924; instructor, Dept. Mech. Engrg., Rensselaer Poly. Inst., 1924-25. 1925-26, mech. dftsman, Aluminum Co. of America; with Aluminum Co. of Canada, Ltd., as follows: 1926-28, ap'ticeship. ind. plant operation, Shawinigan Falls, Que.; 1928-29, layout & operation of Permanent Mould Foundry, Toronto; 1929-30, opening operation of plant in Osaka, Japan; 1931-33, on loan to Northern Aluminium Co., England; 1934-39, chief plant engr., Toronto; 1939-40, asst. design & constrn., Kingston Works; 1940-42 to date, asst. chief engr., head office, Mtl.

References: A. W. Whitaker, F. L. Lawton, M. N. Hay, K. Winslow, D. G. Elliot, M. E. Hornback.

THOMAS—JOHN WILBERT, of Ottawa, Ont. Born at Winnipeg, Man., June 7th, 1914. Educ.: B.Sc. (chem.), Univ. of Alta., 1939. Summer employm't, Britannia Mining & Smelting Co.; Int. Nickel Co.; since July 1940 to date on active service as follows: Sec. Officer, R.C.E., 2nd Bn., (4 mos.); Works Officer, 2 Bn., R.C.E., (9 mos.); Field Engr., H.Q., R.C.E. 1 Cdn. A. Tps., (4 mos.); Sec. Officer, 1 Mech. Equipt. Coy., R.C.E., (2 mos.); 2 i/c 13 Cdn. Field Coy., R.C.E., (3 mos.); Field Engr., H.Q., R.C.E., 1 Cdn. Corps Tps., (9 mos.); Adjt. H.Q., R.C.E., 1 Cdn. Corps Tps., (2 mos.); O.C., 4 Cdn. Fld. Pk. Sgn., (1 mo.). At present with Directorate Engr. Development, N.D.H.Q., Ottawa, with rank of Major.

References: E. C. Thorne, J. L. Melville, W. J. Bright.

VERRIER—EDWARD JOHN, of Winnipeg, Man. Born at Rugby, Eng., Jan. 29th, 1899. Educ.: Rugby Tech. Coll., Rugby, Eng., 4 yrs.; stat'ny. engr. license in Quebec and N'fld. 1916-21, mech. engr., ap'ticeship, Williams & Robinsons, engrs., Rugby, Eng.; 1921-23, erection & design steam turbines & generators in England, English Electric Co., Ltd.; 1923-26, engr., Tembi Power House, S. Persia, Anglo-Persian Oil Co., Ltd.; 1926-28, chief engr., supt. of steam, light, heat, water & power, Venezuelan Oil Co., Ltd., Cabimus, Venezuela; 1928 (6 mos.), chief engr., of steam plant, Mexico Light, Heat & Power Co., Ltd., Mexico City; 1928-29, engr. i/c of constrn. & initial operation of steam power plant, Perak River; power plant, Ipoh, State of Perak; 1929-31, asst. chief engr., Canada Sugar Refinery, Mtl.; 1931-34, supt. of steam plant & services, Anglo-N'fld. Development Co., Grand Falls, N'fld.; 1934-40, bldg. supt., Mtl. Gen. Hospital & Windsor Hotel, Mtl.; since 1940 with R.C.A.F., Works & Bldgs., as Staff Officer at No. 2 Air Command Hdqts., Winnipeg. Present rank S/L. (Affiliate) 1934.

References: H. S. Windeler, G. N. Thomas, C. H. L. Jones, K. G. Cameron, F. M. Pratt, N. S. Walsh.

FOR TRANSFER FROM JUNIOR

McGINNIS—ARTHUR DAVID, W/C, R.C.A.F., of Kingston, Ont. Born at Philipsburg, Que., Aug. 14th, 1917. Educ.: B.Sc., Queen's Univ., 1938, M.C.E. Cornell Univ., 1939; R.P.E. of Ont.; 1938-40, genl. supt. McGinnis & O'Connor on highway & aerodrome constrn.; 1940-41, lecturing at Queen's Univ. on highway, rlwy. and structural engrg.; 1941-42, travelling inspecting engr., R.C.A.F.; 1942-44 officer i/c aerodrome design, constrn. & mtce. etc. at R.C.A.F. Western Air Command; 1944 to date, R.C.A.F. Staff Officer Constrn. Engrg., responsible for all constrn. & mtce. on North West Staging Route. At present on posting overseas for special duty. (Jr. 1940)

References: T. A. McGinnis, D. S. Ellis, J. A. Jones, W. L. Malcolm, C. C. Folger.

FOR TRANSFER FROM STUDENT

ARCHIBALD—HUESTIS EVERETT, of 11 Poplar Plains Crescent, Toronto, Ont. Born at St. Stephen, N.B., Oct. 8th, 1920. Educ.: B.A.Sc (civil), Univ. of Toronto, 1943; 1943-45, Lieut. in R.C.E.; Jan. 1945 to date, asst. engr., Dept. of Planning & Development, Toronto (community Planning Branch. (St. 1942).

References: A. E. K. Bunnell, R. F. Legget, C. F. Morrison.

HOPPS—JOHN ALEXANDER, of 127 Ste. Marie St., Hull, Que. Born at Winnipeg, Man., May 21st, 1919. Educ.: B.Sc. (elec.), univ. of Manitoba, 1941; 1941 to date, Elec. Engr. in chge. Radio Branch Supply Dept., National Research Council, Ottawa. (St. 1941).

References: E. P. Fetherstonhaugh, N. M. Hall, A. E. MacDonald, R. W. Boyle, A. M. Hudson.

SIMPSON—CHARLES CECIL, of 2301 Beaconsfield Ave., Montreal. Born at Spokane, Wash., Oct. 12th, 1915. Educ.: B.Sc., (Elec.), Univ. of Alberta, 1937; with Northern Electric Company, Montreal, as engr. since 1942 and from 1942-44 specialized in shipbldg. electrics; 1944 to date, on loan to Wartime Shipbuilding Ltd., Montreal, to coordinate prodn. of Admiralty Pattern Cable and to assist in electrics of Naval Shipbldg. Programme. (St. 1938).

References: R. S. L. Wilson, P. L. Pratley, W. R. Bunting, E. W. Jeffrey, G. O. Vogan.

SLIPP—JOHN GILLESPIE, F/L., R.C.A.F., overseas. Born at Trochu, Alta., May 29th, 1918. Educ.: B.Sc. (Elec.), Univ. of Alta., 1939; 1939-40, test course, Can. Gen. Elec. Co.; 1940-41, test & inspn. dept., H.E.P.C., of Ont.; 1941 to present, Signals Officer in R.C.A.F. and for past 3 yrs., Chief Signals Officer at numerous stations having supervision of tech. training of personnel & engaged in organization & installn. of communications facilities at a number of new stations. (St. 1939)

References: W. P. Dobson, R. B. Young.

STOLLERY—CHARLES ALEX, A/Lt. Cdr. SB (E), of Halifax, N.S. Born at Edmonton, Alta., May 11th, 1915. Educ.: B.Sc. (Civil), Univ. of Alta., 1941; 1941-42, field & design engr. for City of Edmonton Power Plant; 1942, field engr. Demerara Bauxite Co., British Guiana and for Aluminum Co. of Can. at Beauharnois, Que.; 1943, design engr. at head office, Aluminum Co. of Can.; with R.C.N.V.R., as follows: 1943-44, prodn. officer and 1944 to date asst. mgr., constrn. dept., H.M.C. Dockyard, Halifax. (St. 1941).

References: R. S. L. Wilson, I. F. Morrison, R. M. Hardy, R. G. Watson, H. F. Kent, S. R. Banks.

VAUGHAN—ROBERT POLK, S/L, R.C.A.F., of 310 Roslyn Ave., Westmount, Que. Born at Montreal, Oct. 24th, 1915. Educ: B. Eng. (Mech.), McGill Univ., 1940; 1940, asst. in prodn. dept., Dominion Engrg. Works, Lachine, Que.; with R.C.A.F. as follows: 1941 (4 mos.) F/O on staff of Directorate of Engrg. Ottawa; 1941-43, Squadron Engineer Officer with operational squadrons overseas; 1943 to Feb. 1945 Chief Technical Officer on Heavy Bomber Station, Overseas, i/c all tech. ground crew on station & resp. for repair & mtce. of aircraft & equipment; at presnet S/L attached to No. 1 Air Command. Trenton. (St. 1939)

References: J. G. Notman, H. Crombie, G. J. Dodd, E. Brown, C. M. McKergow.

LIBRARY NOTES *(Continued from page 336)*

C22.4 No. 100—Definitions and General Requirements:

This Specification will include a general Preface, Statement of Scope, Definitions, Legal Status of the Code, List of Personnel of Committee on C.E. Code Part IV and Subsidiary Panels. In addition there will be six appendices: A—Theory of Interference, B—Coupling, C—Psychological Factors, D—Principles Underlying the Suppression of Inductive Interference, E—List of British and Foreign Co-operating Organizations, and F—Bibliography of Technical References.

C22.4 No. 101—Measurements of Radio Interference:

Describes the method of measuring both radiated and conducted radio interference in the frequency range up to 30,000 kilocycles. It describes the method of using a calibrated radio receiver as a measuring instrument in order that measurements may be made with the use of instruments which are readily available.

C22.4 No. 102—Radio Interference from Street Railways:

Sets a tolerable limit of interference from new equipment during normal operation.

C22.4 No. 103—Radio Interference from Power Lines:

Defines tolerable limits of radio interference from power and distribution lines operating on voltages between 750 volts and 70,000 volts.

C22.4 No. 104—Radio Interference from Motor Vehicles:

Applies to new vehicles and covers the frequency band from 200 kilocycles to 30,000 kilocycles.

C22.4 No. 105—Radio Interference from Low Voltage Apparatus:

Prescribes tolerable limits of radio interference at the terminals of electrical apparatus for use on lines of less than 750 volts.

CC22.4 No. 106—Radio Interference from Radio Frequency Generators (Industrial and Medical):

Applies to radio frequency generators used by Industry for induction and dielectric heating and by practitioners for diathermy and electro surgery.

C22.4 No. 107—Radio Interference from Communication Systems:

Covers the tolerable limit of radiation from communication lines and systems.

C22.4 No. 108—Radio Interference Suppressors:

This Specification is also issued in Part II of the C.E. Code as C22.2 No. 8. It deals with capacitors, inductors, resistors and complete suppressors (filters or surge traps) for suppressing radio interference.

The approval of Specification C22.2 No. 8 is now being expedited and its early publication is expected. Copies will be available in the near future. In the meantime the CSA Approvals Administrative Board has approved of the Second Draft of it for use as laboratory requirements pending its issuance as a CSA standard.

Employment Service Bureau

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. 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. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.

NOTICE

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 is—

(a) unemployed;

(b) 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

MECHANICAL ENGINEER DRAUGHTSMEN wanted. See page 54 of the advertising section.

CHEMICAL, MECHANICAL, CIVIL ENGINEERS wanted. See page 54 of the advertising section.

DRAUGHTSMEN AND ENGINEERS, Mechanical, electrical and concrete draughtsmen and designers wanted by pulp and paper company. Apply to Box No. 2890-V.

TRANSPORTATION ENGINEER wanted. See page 54 of the advertising section.

ELECTRICAL SALES ENGINEER for western firm specializing in engineering sales and service of all types of electric machinery and similar equipment. The position would be permanent and on a salary basis. Applicants should state: training, experience, age, nationality and availability. Apply to Box No. 2911-V.

GRADUATE MECHANICAL ENGINEER about thirty for a well-established concern engineering and manufacturing conveying equipment in their own plant. A working knowledge of mechanics and light structural steel, along with the aptitude for applying same, also the desire to learn the conveying business from the ground up is essential. This is a permanent position for the right man. Apply to Box No. 2942-V.

Wanted!

ELECTRONICS ENGINEER

Electronics Engineer, University graduate with several years experience on communication work, wanted by established electrical manufacturing firm for engineering new installations utilizing electronics equipment.

Apply to Box 2957-V, The Engineering Journal, 2050 Mansfield St., Montreal, Que.

Rehabilitation Employment

The Engineering Institute has established a department with the sole object of providing a rehabilitation service to members in uniform.

This department is now in operation and it is the intention to develop it to the point where it can render really valuable assistance to returning members. To this end a special committee has been established known as the Advisory Committee on Rehabilitation, under the chairmanship of Major-General Howard Kennedy.

A letter and questionnaire were sent in March to all members in the services, and already three hundred and ten replies have been received. They indicate that the service can be of assistance to about two-thirds of the total. For this reason, it would be of great value to the committee, and therefore, to the returning members, if employers would inform the Institute of their probable post war requirements.

It is appreciated that most firms have a comprehensive rehabilitation scheme for their own returning personnel. Naturally such proposals take precedence over all others but it is still hoped that there will be openings for the large number of returning members who will not have such advantages. All employers will be familiar with the work of the Wartime Bureau of Technical Personnel. The Institute service is not intended to replace this but rather to give to members an additional service on behalf of their fellow members, which it is believed will aid materially in assimilating them into civilian life.

It would facilitate the work of the committee if employers would furnish details of possible vacancies including:

1. Nature of work
2. Temporary or permanent
3. Salary range
4. Location
5. Experience required
6. Must position be filled immediately or can it wait for post-hostility discharge of candidate?

With this information, negotiations can be started now that should work out eventually to the advantage of everyone.

SITUATIONS WANTED

ELECTRICAL ENGINEER, M.E.I.C., age 38, B.Sc. McGill. Widespread experience on electrical maintenance, radio and telephone engineering. Five years with the R.C.A.F. in the aeronautical engineering branch specializing on electrical work. Immediate experience before joining the R.C.A.F. was four years on electrical maintenance in paper mills, including experience with Harland and General Electric drives. Interested in maintenance, development or layout design of electrical equipment. Not available until release from the R.C.A.F. but wishes to make contacts for a post-war position. Apply to Box No. 12-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., with 18 years' experience in iron industry; machine tools, steel cabinets, conveyors, etc., light metal and food processing industry, has held executive positions in charge of production, industrial engineering, designing, buying, selling, financing. An expert in cost accounting and lighting, a man with good ideas, tact, initiative and sound technical judgment, available immediately. Age 41, married, Canadian bilingual. Apply to Box No. 1730-W.

CIVIL ENGINEER desires part-time employment. Experience in design, estimating, draughting, supervising work, field engineer in municipal and highway works, also in heating, air-conditioning and mining. Owns a car. Apply to Box No. 1859-W.

ENGINEER, M.E.I.C., R.P.E.(Ont.), presently employed as assistant engineer and chief draughtsman. Desires new connection due to contemplated staff reduction in a war industry. Extensive experience in structural steel and plate fabrication miscellaneous builders' iron work and reinforced concrete as engineer and draughtsman, estimating and sales. Apply to Box No. 2208-W.

CIVIL ENGINEER, M.E.I.C., R.P.E.(Ont.), B.A.Sc., Toronto. Resident for past 12 years in U.S., New York, desires to return permanently to Canada. Thirty-two years' experience on design and construction of harbour works, piers, dry docks, quay walls, cofferdams, foundations, steel and concrete buildings. Specialist steel sheet piling, railway location and construction. Public utility appraisals, industrial engineering, sales engineering and promotional work including export sales, journalistic and advertising work. Foreign experience in China, West Indies, Alaska. Good organizer and executive. World War I veteran. Seeking administrative or supervisory opening or sound sales or business opening. Willing to travel. Apply to box No. 2476-W.

MECHANICAL ENGINEER, 41 with 17 years' experience in machine shop, production of precision parts, internal combustion engines, tool design, seeks responsible position; will consider association with reputable consulting engineers. Apply to Box No. 2480-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., age 35, married, 6 years general office experience, 4½ years on maintenance, inspection and construction in oil refinery, 3 years supervising construction in tropics, 1½ years on structural steel and reinforced concrete design, piping and plant layouts. Desires field position, preferably on construction work. Location immaterial. Registered with W.B.T.P. and available May 1st. Apply to Box No. 2481-W.

GRADUATE CIVIL ENGINEER, University of Manitoba, age 33. During past six years have held technical and administrative positions in various industries. Would like sales opening or business proposition where ability to approach business or government officials, initiative and organizing ability, and a liking of people would be of value. Presently in Ontario, would consider locating in West. Available on short notice, registered with W.B.T.P. Apply to Box No. 2500-V.

Industrial News

Industrial development—new products—changes in personnel—special events—trade literature

NEW C.G.E. PLANT

A $350,000 addition to their plant for the manufacture of glyptal alkyd-type resins will be built shortly by Canadian General Electric Co. Ltd., at its Davenport Works in Toronto. It is expected that the plant will be in full operation in July. The new plant will be three storeys and of reinforced concrete construction. In addition to the latest chemical processing equipment the plant will house a large modern laboratory. The total floor area including both manufacturing and storage space will be approximately 30,000 square feet.

PLASTIC BRUSH BRISTLES

The Plastics Division of Canadian Industries Limited, Montreal, Que., have issued a booklet on the use of nylon monofilament for making industrial and domestic brush bristles and sporting goods applications. The use of nylon bristles in ten industries, such as those of textile, sewerage, dry cleaning, dairy and electroplating, etc., are described, and a short history of nylon and an explanation of why brush bristles are being made of it are given. The booklet also contains a list of nine advantages of these brush bristles and a sample of the monofilament.

SANGAMO APPOINTMENT

Sangamo Company, Limited, have announced the appointment of P. W. Howlett as eastern district manager, with headquarters in Montreal, succeeding the late D. H. Ross.

Mr. Howlett has enjoyed 27 years experience with the company's products in manufacturing and engineering, and his knowledge of the many applications of the various types of meters and Wagner motors will be of valuable assistance to him in his new position.

VARIABLE RATIO TRANSFORMER

Ferranti Electric Limited, Mount Dennis, Toronto, Ont., have prepared a 4-page bulletin, No. 603, which describes and illustrates a variable ratio transformer for manual control of voltage, speed, power, heat, and light. Two models, one for 60 cycles 115 volts, and the other for 60 cycles 230 volts are discussed in detail, and operating instructions dealing with installation, inspection, mounting, connections, fuses, maintenance and three-phase operation are given.

Major James E. Hahn, D.S.O., M.C.

J. D. Willis

C.G.E. APPOINTMENT

According to a recent announcement, J. D. Willis has been appointed assistant manager of the industrial division, apparatus department, Canadian General Electric Co. Ltd.

Formerly, Mr. Willis was manager of the industrial section of the apparatus division, Toronto district office, in which capacity he acquired broad experience in the application and engineering of all types of industrial apparatus.

Following a year in C.G.E.'s test department, Mr. Willis joined the company's industrial control engineering department at Peterborough in 1928 and was later transferred to Toronto as industrial control specialist.

HEAVY STEEL FORMS

Dominion Bridge Co. Ltd., Lachine, Que., recently issued a pamphlet which illustrates and lists the variety of work constantly being produced at the company's plants. Chief items featured are: riveted and welded plate work, hydraulic regulating gates and operating machinery, water tube boilers, bridgework, mine equipment of all kinds, contractors' and general equipment, elevator equipment, oil well supplies, and ornamental ironwork.

APPOINTED DIRECTORS

Following the annual meeting of the shareholders of English Electric Co. of Canada Limited at the head office of the company, St. Catharines, Ont., A. S. Tait, president, announced the following appointments to the board of directors:

Hon. G. Peter Campbell, K.C., Toronto, Senator and Director of several companies, Major James E. Hahn, D.S.O., M.C., president, John Inglis Co. Ltd., Toronto, A. L. Ainsworth, vice-president and general manager, John Inglis Co. Ltd., H. C. Blenkhorn, general manager of the company now also becomes vice-president.

New appointments within the company are F. C. Douglas, treasurer, who becomes secretary-treasurer, and S. G. Cruttenden, assistant treasurer, who becomes comptroller.

JOINS ENGINEERING STAFF

Appointment of R. H. Andrews to the engineering staff of Canada Wire & Cable Co. Ltd. is announced by the general manager, J. L. McKay-Clements, as part of a plan to render an enlarged engineering service to customers and to assist in bringing into peacetime applications many new and improved products developed during the war years.

Mr. Andrews has received his release from the R.C.A.F., having served as chief electrical engineer in the division of construction engineering at Air Force Headquarters, Ottawa, in charge of all electrical construction for the Joint Air Training Plan and other projects for defence of Canada. Prior to enlisting in July, 1940, Mr. Andrews was assistant chief engineer of the Winnipeg Hydro Electric System.

VIBRATION CONTROL

Atlas Asbestos Co. Ltd., Montreal, Que., have issued a 24-page catalogue No. *G*-100, which describes several types of vibration dampers, isolators, and rubber mountings for use in marine applications, in the isolation of fans, pumps, small Diesel engines and similar lightweight machinery, and for conditions of vertical loading and slight lateral thrust. The main features and applications of this equipment are discussed and tables containing rated load in pounds, shipping weight in pounds, levelling bolt and foundation bolts in inches, and dimensions are given. Also included are three articles which discuss in detail vibration control for main propulsion engines, the theory of elastic engine supports, and the use of steel spring, cork, and rubber in vibration control.

ATLAS STEEL TOPICS

Volume 1, No. 6 of Atlas Steel Topics which is issued by Atlas Steels Limited, Welland, Ont., is devoted mainly to a description of the Pan-American Highway and the countries it traverses, with all articles written in English, Spanish and Portuguese. A map of the New World and numerous excellent photographs, with captions, assist in describing this recent development in Pan American communications. A second article describes the production of the company's brake-die steel to meet the heavy demands of Canada's war efforts.

H. C. Blenkhorn

THE ENGINEERING JOURNAL

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CONTENTS

COVER PICTURE

Pictured on the cover is the giant war tested Douglas DC-4, of which the DC-4M shown on page 343 is the Canadian version. The DC-4 is the commercial model of the U.S. Army C-54 combat-transport and the Navy R5D, now flying millions of miles per month over continents and all oceans on daily war schedules.

THE PRINCIPLES INVOLVED IN A MODERN CONCEPT OF AIRLINE OPERATION

JAMES T. BAIN
Superintendent of Engineering and Maintenance, Trans-Canada Air Lines, Winnipeg, Man.

Paper presented at the Fifty-Ninth Annual General and Professional Meeting of The Engineering Institute of Canada, at Winnipeg, Man., on February 8th, 1945.

Introduction

Many of you gentlemen in this room are regular users of the commercial airlines of this continent. You have discussed these airlines and, by your discussions, you have helped to build them. Your advice and your criticisms have assisted greatly in overcoming the trials and problems that are now behind us.

Now opening up in front of us is a new era of opportunity in air transportation; a new era which will demand the adoption of new principles, the employment of new techniques, and the striving for new ideals. All that has gone before has merely laid the ground work for what is now to come. The amount of building up to be done is tremendous, the time is all too short, and much hard work lies ahead if the vast horizons of an air age are to be reached.

The knowledge exists, the tools are available and success can be assured if we attack the problems in front of us with common sense and aggression.

The Present Airlines

Without labouring on the many difficulties which, under war conditions, have virtually stopped the development of the airlines, it is necessary to briefly review the present conditions in order to show where the deficiencies lie and consequently where the corrections must be made.

The function and stock-in-trade of an airline is speed of transport with safety, regularity, comfort and convenience. I propose to take each of these contributing components of the main function for separate discussion.

Speed of Airline Flight

The inherent speed of air transportation is the essence of its existence and there are no distances over which the aeroplane cannot show up to advantage against any form of surface travel. The most spectacular advantage lies, of course, in long distance travel or over geographical areas that do not permit adequate surface methods. Statistics show that the average airline passenger journey on Trans-Canada Air Lines is 538 miles and that for each passenger who travels from Montreal to Vancouver, there are twelve who fly from Montreal to Toronto. It can be readily shown that the greatest demands for transportation are over the short distances between adjacent populated areas, and it is between such centres that the present airlines are of the least value. The inaccessibility of airports, the inadequacies of pick-up and delivery services, together with the complications of reservations, manifests, customs clearance and the like do much to nullify the advantage of air transport speed over short distances.

Here, then, is the first major deficiency which must be overcome. Ground facilities must be geared up to retain the advantage of speed in the air. By the provision of special highways or special trains, and with overall revision to the necessary ground handling procedures, this may be achieved. With the certainty that automobiles and railroads are going to provide competition in short distance travel, the airlines cannot hope to succeed on the present basis. It is not sufficient to compute speed from airport to airport. The complete journey must be considered, and the facilities provided to give the fastest possible overall journey time.

Safety in Airline Travel

The safety of air travel is probably the most misunderstood of all the factors in air transportation, and remains one of the greatest deterrents to the universal acceptance of the aeroplane as a transport vehicle.

An insurance man will readily agree that an airline passenger is a better risk than the user of a private automobile, but because airline accidents are usually highly spectacular, the average man in the street does not realize that millions of unspectacular miles are flown in regular service for each fatality that occurs.

Airline accidents have decreased markedly during the past decade. We now fly seven times the distance per fatality to that flown in the early 1930's. The actual statistical figures at present show 3.9 passenger deaths for every 100,000,000 passenger miles flown, and it is only when this figure is compared to railroad passenger fatalities that it is realized that the standard of safety on the airlines can, and must, be greatly improved. There is no fundamental reason why airline travel should be less safe than any other form of transportation.

Let us review this subject of safety in more detail.

Development of Safety Standards

In the pioneer days of flight, the flying machine was definitely dangerous and hundreds of gallant men gave their lives in the struggle for mastery of the air. From these early days there has been a steady forward march of technical development and improvement. Complementing this growth of technical knowledge has been the formulation of airworthiness regulations and governmental controls which have eliminated the opportunists and the " wildcats ". Mechanical failures, due to lack of basic engineering knowledge, no longer jeopardize the safety of flight and, as a vehicle, the aeroplane is as safe as train or steamship.

The associated operational arts and equipment have also advanced tremendously. Aircraft instruments and accessories now permit precision in aircraft manoeuvres. Meteorology is approaching the status of an exact science and aircraft radio now gives us exactitude in navigation and communication facilities. It is the application of these developments that has given the airlines their greatly improved standards of safety.

The Human Element in Aircraft Operation

The increased efficiency and precision of the aeroplane has greatly extended the scope of airline operations. We now have the equipment and knowledge to operate safely under hitherto impossible atmospheric conditions but there is still one factor, and possibly the most important of all factors, on which safety in flight is completely reliant. We still rely on human judgment for the final handling of aircraft. The safety of air transportation is still completely in the hands of the individual pilot of each aircraft.

It has been argued that the addition of the specialized equipment, or of specialist members to the flight crew, has decreased the vulnerability of the human element. This is not so; a study of the facts quickly shows, and is proved beyond doubt by the record, that the human element is by far the greatest single source of accident.

Whilst it is true that the development of safety equipment for aircraft has greatly improved our safety standards, it is also true that each new improvement in technique or each new so-called "safety device" has placed a further demand on the skill and knowledge of the pilot. Each advance has given improvement in safety but each advance has also been used to make possible the operation of aircraft into atmospheric conditions still more adverse than previously.

There is no assignment in the transportation industry which compares in severity with the terrific demands made on the pilot of an airline aircraft. No additional devices, or crew members, or training can rectify this condition. The defect is fundamental and can be corrected only by elimination of the human element as the interpreting and transforming medium.

Improvement of Safety Standards by Automatic Flight Control

Let us consider now how this major deficiency can be corrected; how we can apply our accumulated knowledge to eliminating the shortcomings of human judgment.

In all branches of industry the machine and automatic controls are used to complete operations that require exactitude far beyond human ability or powers

THE DOUGLAS DC-4M

The Douglas DC-4M, now in production at Canadair Limited, Montreal, for T.C.A., is an all-metal, low-wing, transport monoplane with fully retractable tricycle landing gear. The four Rolls Royce Merlin power plants are, unlike the older liquid cooled types, circular in cross section in order to provide low drag radiators of sufficient size for operations in tropical zones as well as frigid.

Accommodation is provided for 40 day-passengers or 18 sleepers. The crew of six will consist of a captain, first officer, navigator, radio operator and two cabin attendants for long trans-ocean flights; the radio operator and navigator will be omitted on domestic flights.

Safety is stressed by using the highly powered Merlin Mark 150 engines. Automatically synchronized propellers are used with reversing features to provide aerodynamic braking for landing. The landing gear can in an emergency be extended in flight without the use of the hydraulic system by its own weight and aerodynamic loads.

The excellent high altitude performance of the two stage supercharged Merlin engines will permit the aeroplane to maintain a high degree of regularity on such a run as the North Atlantic where icing conditions must be topped on occasions.

The Rolls Royce power plant has been standardized so that it may be installed in any one of the four positions. Should trouble develop in a power plant that cannot be rectified quickly, the entire power plant may be removed and a fully tested spare unit be installed in 15 minutes.

The DC-4M will be fast, with a top speed of 350 m.p.h. at its maximum gross weight of 73,000 lb. and at 23,600 ft. At the same weight it will cruise at 324 m.p.h. at 22,500 ft.

For passenger comfort and convenience the luxurious interior will, in addition to the normal seats, incorporate three alcoves with a club arrangement of seats, a coat alcove, and two dressing rooms with separate toilets. A galley will be provided from which hot meals will be served.

of co-ordination. With an electronic camera, we can photograph the flight of a bullet from a rifle; by new uses of radio we can scan a landscape invisible to the human eye; we can complete machining operations to one hundred thousandth of an inch; complete railroad systems are equipped with automatic controls that have completely eliminated the possibility of human error.

The application of the machine clearly presents the ability to remove the limiting human element from the flight control of aircraft.

For flight operation we now provide indicators which, correctly interpreted by the pilot, will permit him to fly accurately under any circumstances. Why stop there? We must go one step further and eliminate the need for human interpretation. In place of the indicators let us provide positive mechanical controls which can, and will, do the job of flight control more accurately than could ever be possible by human agency.

Let us look at the same question from a different angle for a moment, and assume that the anticipated expansion of air traffic does actually materialize. Consider a major airport such as Montreal, Toronto or New York at peak periods of the day with aircraft on each field arriving and departing at intervals of fifteen seconds. Without some form of automatic control, each minor weather deterioration would hopelessly tangle all airline traffic, completely destroy regularity, and be well beyond the ability of any ground control officer to handle with the essential degree of safety.

We are constantly striving to improve the skill and knowledge of our flight crews by training, checking and re-checking. By the establishing of low limits of weather, we are maintaining a high standard of safety. It is progress beyond this present standard that demands the adoption of the new principle of eliminating the human element.

It is no part of this proposal to send robot aircraft into the sky without flight crews on board, nor is it intended that automatic flight control be immediately adopted as a radical change from the present procedures. It is contended, however, that the underlying principle must be adopted before any real progress can be made.

With the adoption of this principle, the present pilots will become captains of aircraft in the true sense of the word. With hands and mind free of the encumbrances of a host of mechanical implements, our future airline captain will be able to apply all his mature judgment to the governing of flight conditions and to the achievement of the ultimate of complete safety in flight.

Regularity in Airline Operation

Very closely allied to, and in a major degree synonymous with safety in flight is regularity of operation. There can be no true regularity without safety and discussion of regularity must, of necessity, overlap considerably on much that has already been discussed.

Airline operations break readily into two major sections:

1. The maintenance and overhaul of aircraft to ensure mechanical perfection at all times, and
2. The flight of the aircraft from departure point to arrival at destination.

Examining first the function of maintenance and overhaul, we find that all airlines, of necessity, follow the same pattern.

Maintenance and Overhaul of Present Airline Aircraft

In the design and construction of airline aircraft, the manufacturers have always concentrated on the aerodynamic features of their products to the almost total exclusion of everything else. This, naturally, results in a lack of maintenance facility which is directly reflected in the practices outlined below.

After certain specified periods in operation, each aircraft is removed from service for inspection and what may be called "preventative maintenance" work.

The period the aircraft remains out of service depends on the particular routine to be completed and may vary from a few hours, for the frequent "line" inspection, to several days for a major overhaul. With the emphasis that is placed on airworthiness, the task of maintenance is a large one and even with the best efforts for maximum service, the airlines are fortunate to average twelve hours per day per aircraft in service.

Maintenance supervisors are always faced with the uncertainty of the immediate future, and when mechanical irregularities occur during service, even minor troubles such as defective sparking plugs or cowl flaps can cause delays of some hours in scheduled operation. Such event invariably necessitates the rushed concentration of highly skilled ground mechanics to correct the defect and get the aircraft on its way. In cases of more severe nature where trouble shooting is difficult, a "ferry" aircraft must be sent to collect the load and allow the flight to continue. Such delays are, of course, fatal to regularity and may affect the operation of a large section of the airline until everything is back to normal.

For just as long as aircraft are built as one complete unit, so will maintenance facility be lacking, and the ultimate in mechanical regularity will not be achieved.

Elimination of Maintenance Irregularity by "Unit Assembly"

It is entirely possible to overcome the basic deficiencies in the present system of aircraft maintenance, and at the same time, to greatly increase aircraft utilization and mechanical regularity in operation. By the adoption of what can be called the "unit assembly" method of aircraft construction, the essential facility will be provided. I would like to elaborate further on what is meant by "unit assembly".

The principle that must be adopted is the breaking down of the aeroplane from one complete and complicated unit into a number of self-contained and easily replaceable units. As an example of what I mean, it should be possible to remove the entire power plant from an aircraft by simply disconnecting a few easily accessible bolts and connections. Each power plant should be exactly alike and not peculiar to any hand or position. The replacement power plant must be capable of complete testing and adjustment on service stands, and require no adjustments when mounted on the aircraft. The exchanging of such a power plant should occupy only a very few minutes. Our present specification for the Rolls-Royce power plants in TCA's new Douglas equipment calls for a maximum of fifteen minutes to change an engine, and we are confident that this will be achieved.

With this principle applied to all the component parts and systems in an aircraft, a picture very different from the present one would be seen in the maintenance of aircraft and mechanical regularity in service. The advantages can be listed as follows:

1. The interruption of flight schedule by mechanical defects would be reduced to a minimum by the speedy replacement of the defective component, the reconditioning of the removed unit being handled systematically, and at leisure, after the aircraft has proceeded on its way.
2. The utilization of aircraft would be appreciably stepped up. There is every reason to believe that eighteen hours per day per aircraft in service can be attained.
3. The overhaul and reconditioning of units on a time basis could be planned in a smooth flow of work. The high pressure rush periods, and the expensive slack periods, would be largely eliminated.
4. The total number of aircraft necessary for any given amount of flying could be considerably reduced.
5. Adequate supplies of replacement components can be provided at a fraction of the capital costs involved if regularity of operation is protected by spare aircraft.

So much, then, for the new principles necessary to achieve mechanical regularity. Let us look now at the second main section of operation, that is, the flight of the aircraft from departure point to arrival at destination.

Regularity in Flight Operation

In the discussion on Safety in Airline Operation, the opinion was expressed that elimination of the human element was the essential principle that would allow progress to be made. As with safety, the same principle will do most toward improvements in the regularity of flight operation.

By the elimination of the human element in the flight control of aircraft, and with the adoption of automatic flight control, each phase of airline operation will assume a standard pattern. From the opening of the throttles at take-off to the final application of the brakes after landing, each and every part of the operation will be precise and uniform in execution.

So long as human judgment is used in the flight operations of aircraft, so will there be a lack of uniformity in aircraft manoeuvres. So long as we lack uniformity in aircraft manoeuvres, so will we be unable to achieve the essential regularity.

Automatic flight control is not intended as a bad weather or emergency procedure, rather it is intended as a standard procedure for equal use in good weather as in bad.

By the duplication or triplication, if necessary, of the automatic equipment, we can eliminate the fear of failure at critical moments, and by the correct interconnection of the control systems, we can handle any emergent situation with greater accuracy than is possible by human agency. A machine can do a job quicker than a man can realize that something requires to be done.

It has been argued that the weight of automatic control equipment would involve a payload penalty which could not be supported in commercial operations. This is a fallacy that is easily disposed of by the certainty that regularity of operation will many times over increase the traffic which is enjoyed by the present system of operation. There is a principle involved in this which may be exemplified this way.

We have all seen advertisements in the various trade periodicals and magazines which quote the dollar values of " one pound of payload " in a commercial aeroplane. For a stabilized operation which has no ability of expansion, these mathematical reductions are accurate and useful, but in an operation which has the ability to expand, the value of the payload pounds can be measured only in terms of ultimate effect on total traffic. We can expend a lot of payload pounds if such expenditure results in multiplication of the loads offering.

Comfort and Convenience

The airlines have always given a high standard of personal service. The comfort of passengers has taken second place only to the essential functions of operations, but the airline traffic volume has been too small up to the present to permit the full development of the associated airline facilities.

In the new era of air transportation that lies ahead, sweeping changes in many aspects of airline activities will be directly reflected in the development of new standards of comfort and convenience. Let us examine some of these changes and their effect on the airlines.

Revision of Station Buildings and Facilities

The expansion and intensification of airline service which can be logically anticipated will demand considerable revision to airline station facilities. This revision becomes necessary from two points of view.

First, there is speed of handling. The use of even medium-sized four-engined aircraft, carrying forty-odd passengers and some thousands of pounds of mail and general cargo, becomes a very different problem from the comparatively easily handled twin-engined aircraft to which we are presently accustomed. No passenger can be expected to use airlines for short distance travel when the advantage of aircraft speed of transport is lost by hanging around waiting for luggage to be unloaded. Again, if station handling times are not held to absolute minima, the cost of operation is increased by the loss of hours of aircraft utilization.

The second reason demanding revision of airline station facilities is the peculiarities of our northern latitudes. Grounded aircraft either become unbearably hot in the summer sun, or potential causes of pneumonia in winter.

Realization of these deficiencies has caused study of new principle in the construction of airline stations. Tentative investigations are being made of airline station buildings which follow the same general planning as modern railroad terminals and incorporating every facility for the speedy handling in comfortable temperature of every requirement connected with the arrival and departure of the flight. With such facilities, the airline passenger would be under cover from the moment he left his point of departure in the city until finally delivered to his ultimate destination.

Effect of New Aircraft on Comfort and Convenience of Airline Travel

Probably amongst the first of the changes that will attend the availability of new aircraft will be a considerable relief from the difficulty of obtaining travel reservations, or space for express shipments. The war has prohibited the expansion of the airlines to meet the tremendously increased demands of traffic, and in spite of very expensive reservations and priority systems, the airlines have not been able to prevent disappointment and some dissatisfaction amongst its customers.

With the return of the ability to purchase suitable new flight equipment, the airlines will be able to aim at the ideal of entirely eliminating the reservations systems. Once sufficient traffic volume has developed, it may be possible to accept all demands for space in the same manner as the peacetime railroads. By using maximum load factors of 65 to 70 per cent when planning the flight schedules, and by the addition of new services when these load factors are exceeded, there will always be some reserve capacity on the aircraft to take care of the exceptional load or space demand. When the total traffic offering over any route reaches a certain level, it will be economically possible to hold special reserve aircraft to operate as second sections to carry any excess loads on the regular services.

When this intensity of traffic is reached, it will be possible to grab a bag and fly to any point on the system with no more fuss than catching a street car. Such happy circumstances may be a long way off, but it is an ideal that quite positively will be achieved in the future.

Anticipated Low Cost of Operation by Use of New Types

Whilst discussing new aircraft, let us examine the effect of the new types now on the designers drawing boards, and which will become available very quickly after the demands for war production have been satisfied.

By close study of the operators' requirements, the aircraft manufacturers now have confidence in producing aircraft that can be operated at small fractions of the present costs. Some of these new designs incorporate basic design changes, but most of them are carefully evaluated compromises between wing loading, power loading, performance and gross weight, designed to give the best possible economy in operation.

Without going into the detail of actual figures, it is estimated that the cost per passenger-mile will be reduced to less than half the present cost, whilst cargo rates are promised that will be less than present railroad express rates.

If these estimated costs are even approximately correct, the effect of these new aircraft on the airline systems will be tremendous.

If the costs are cut by half, it is reasonable to anticipate at least a doubling of airline traffic. Routes which now cannot support the development of airline services will become economically possible. The fulfilment of the dream of an integrated system of trunk routes and feeder lines, serving all corners of the nation will be much closer to realization.

Without further elaboration of this subject into the possibilities of special mail and air express services, it becomes obvious that the airlines will in the future provide greatly increased convenience and service to the general public.

DISCUSSION

R. D. Speas[1]

Yesterday, I had the good fortune to fly from Toronto to Winnipeg on a Trans-Canada flight with Dr. J. J. Green of the Canadian Air Transport Board. We discussed general phases of respective technical problems, and it was somewhat surprising to me to find that, in the United States, we are studying almost exactly the same problems as you are in Canada. It was surprising—yet I should not have been surprised—for after all, air is the same universally. Yesterday, as far as I could tell, we were in the same type of clouds over Toronto as we entered in leaving New York. We do not have as low temperatures, of course, but basically we are flying in the same air. And so, if ever there has been a sound basis for close international association in a technical field, we have it in airline engineering. I believe that our exchange of technical information has been mutually helpful in the past and we sincerely hope that the ties of technical association can be increased in the future.

I saw the Trans-Canada aircraft at close hand. The apparent overall smooth functioning of all departments in the airline, as well as the excellent mechanical condition of the aircraft during the flight from New York to Winnipeg, were impressive. Last night and to-day, after hearing the excellent technical papers of Trans-Canada personnel, talking to the authors and others responsible for Trans-Canada engineering and operations, and visiting the aircraft shops, I realized that the extremely high standards of Trans-Canada's Engineering, Maintenance, and Operations are the result of wise and efficient management, the good reputation of which is widespread below the border.

In his paper, Mr. Bain mentioned the importance of quick engine change in regular airline operation and we hasten to agree with him on the problem of quick change features for aircraft and engine components. We do believe, however, that it is important not to overlook the small units in such an analysis. For example, a recent aircraft design allows a thirty-minute change, yet requires hours for a simple spark plug change. In actual airline operation, it usually is not logical to continue to change engines until a good set of plugs is found, so the spark plug problem cannot be made entirely secondary to the basic engine change problem.

In mentioning various items affecting regularity of flight operations, it is felt that an important factor is the further development of meteorological science. General flight condition forecast will undoubtedly continue to be of great importance in the future in assuring improved reliability as well as regularity, and the meteorologist is the first to say that more exacting methods and procedures must be developed in scientific weather forecasting.

J. A. T. Butler, M.E.I.C.[2]

The elimination of the human element by means of automatic flight control will be a big step forward in advancing air travel, but will most certainly complicate the maintenance problem, as the required equipment will be of a rather intricate nature. Mr.

[1] Assistant to the Vice-President in charge of Engineering, American Airlines, Inc., New York.

[2] Chief Engineer, Fairchild Aircraft Limited, Longueuil, Que.

Bain's goal of 18 hours service per day for every aircraft, if it is to be attained, will require the closest attention to the question of maintenance during the aeroplane design. The principal of unit construction or "repair by replacement" will be of paramount importance. It is fortunate that, generally, an aeroplane that is easy to maintain is also easy to build and the aeroplane manufacturer will undoubtedly give this matter considerably more attention in the future.

Warren T. Dickinson[3]

Mr. Dickinson elaborated at the meeting on Mr. Bain's statement to the effect that short haul traffic outnumbered long haul by 12 to 1. As the time of flight between two points is reduced, the traffic density should increase accordingly. In other words, when and if New York-Chicago time equals 1¾ hrs., the traffic density on this flight should equal the density on the present New York-Washington flight which now takes 1¾ hrs.

With regards to Mr. Bain's statement that larger crews was no logical answer to the problem of increased safety, Mr. Dickinson was of the opinion that until such time as flight is all automatically controlled, the use of larger flight crews did definitely improve safety.

J. J. Green, m.e.i.c.[4]

Mr. Bain has given us a very provocative paper. To my mind, the most important question which he has raised concerns the elimination of the human element in the cockpit. On this point, I am in full agreement with him. During recent years, the cockpits of civil transport aircraft have become more and more complex. Strangely enough, very few complaints have been received from pilots. This may be due to the fact that the pilot takes great pride in his profession and considers that his complicated cockpit is an expression of the high degree of skill and training which he symbolizes. He is proud that it takes a man of his ability to safely operate such a cockpit and might object to a simplification that would reduce his own personal requirements in any way. Aircraft designers, operators, accident investigation boards, and perhaps the thinking public realize, however, that something has got to be done to simplify the duties of the pilot. The rising complication of the cockpit stems from the well-meaning designer and engine manufacturer who, in their zeal to provide the pilot with as much information as possible regarding the operation of his aircraft and engines, keep adding instruments for this purpose. Each instrument added means one more instrument requiring the pilot's supervision, and there seems to be no end in sight.

I find myself in agreement with Mr. Dickinson in his belief that something could be done right now to ease the pilot's duties, without waiting for the fully automatic aeroplane which Mr. Bain has envisaged. The provision of automatic engine controls has received some half-hearted attention in the past and perhaps the solution will be to continue along these lines with fully automatic engine control and operation, giving the pilot only a means of warning when trouble is developing. I believe some work is now being done to provide the pilot with an indication of incipient engine failure.

Mr. Bain's plea for removal of the human element is most timely.

The Author

In reply to Mr. Speas on the question of quick engine changes, I hasten to make it clear that TCA fully intends to use the quick engine change to overcome the practice of trying to find minor troubles in grounded aircraft. There are, of course, many differences in the routes operated by the various airlines which make the standard practice of one unsuitable on another. On Trans-Canada Air Lines, the disposition and number of our stations is such that we can use proved and tested stand-by power plants as replacements and get the aircraft on its way, rather than attempt to shoot the trouble on the grounded aircraft.

Mr. Dickinson has quite correctly pointed out that the larger aircraft in every day operation carry crew members for each specific job. This may reduce the individual pilot's job of supervision to the point where he can cope with what is left, but it does not eliminate the human element. The great majority of aircraft accidents are caused by so called "errors of judgment" *by the pilot*, and occur most frequently during take-off and landing. Additional crew members cannot eliminate this condition, nor can we eliminate the frailty of human judgment by adding more human judgment to it.

I could not agree more heartily than I do with both Mr. Dickinson and Dr. Green in thought that, without waiting for a fully automatic aircraft, we must do something now to ease the pilots' duties. In the specific case of automatic engine controls, much has already been achieved. For example, the Rolls-Royce engines in the Spitfire have a single lever control to the engine. All functions of rpm, boost control, supercharger gear change, etc., are controlled by this single "Stop and Go lever." Similar engine control is planned for TCA's aircraft and will largely be achieved in our DC-4M's. A total of 24 engine controls in the C54 has been reduced to 5, and will finally be reduced to the 4-throttle lever. We have adopted automatic engine controls as a beginning to our adoption of the principle of automatic flight, and as one of the steps in the right direction to the ideals I have attempted to outline in my paper.

[3]Assistant to the Chief Designer, Douglas Aircraft Company, Inc., Santa Monica, California.

[4]Chief Research Aeronautical Engineer, Air Transport Board, Ottawa.

THE ENGINEERING SELECTION OF AN AIRLINE AEROPLANE

JOHN T. DYMENT, M.E.I.C.
Engineering Superintendent, Trans-Canada Air Lines, Winnipeg Man.

Paper presented at the Fifty-Ninth Annual General and Professional Meeting of The Engineering Institute of Canada, at Winnipeg, Man., on February 8th, 1945.

Introduction

The development of an aeroplane suitable for the economical transportation of both passengers and cargo is no longer the work of the manufacturer alone. The airlines themselves contribute greatly to the development of the air-transports of today.

Because the cost of developing a modern aeroplane is so great, the manufacturer can rarely offer more than is actually demanded by his customers. It is safe to say, therefore, that the success of the American commercial air transports is due in no small measure to the exacting demands of the airlines in the United States.

While the United States airlines have ably demonstrated that they know what they want, the aeroplane manufacturers in that country have also demonstrated that they know how to produce what is wanted. This is no small task. For instance, it might be mentioned that the design of a conventional aeroplane by a very experienced engineering staff will require over a million and a half engineering hours and a period of three years before the first production model of the aeroplane could be expected off the assembly line. The cost of the engineering alone over this period will be over two and a half million dollars. The cost of the tooling with its maintenance for the first aeroplane during this period will be at least six and a half million dollars. In other words, an experienced firm will spend over ten million dollars before obtaining its first production model of a new design.

On top of this, a further two or three years of service experience is generally required before it can be said that " most of the bugs are out of the design ".

It is quite obvious that with so much involved, no airline has enough staff, money or time to design aeroplanes for its own use. The most that an airline can do is to prepare a detailed specification of what it wants, amplified possibly with a few helpful suggestions of how to achieve its particular requirements.

This preparation of a detailed specification is a real contribution to the design of the aeroplane for several reasons. The manufacturer's engineers are brought face to face with the problems that have been encountered with existing aeroplanes by the manner in which the airlines prepare their specifications for new aeroplanes. With the receipt of each of these specifications, the manufacturer learns that much more about the operator's viewpoint.

This paper is not intended to describe the procedure followed by an aeroplane manufacturer to design an aeroplane. It is intended to tell the story of how one airline goes about the problem of obtaining the aeroplane it needs.

Airline Engineering

In spite of continual talk about simplification, any modern aeroplane is infinitely more complex than similar types of aeroplanes a few years ago. Because of this, it is necessary to develop specialists in the various technical fields encountered in airline work. Aeronautical engineers, mechanical engineers, electrical engineers, civil engineers, metallurgical engineers, chemical engineers, architects, and various technicians with long practical experience, will be found in an airline engineering department and they are all essential to assist in the running of an airline.

It is these men who, in addition to their normal duties, have the task of preparing the specification for future aeroplanes after countless discussions with other members of the staff. It is their duty to keep abreast with all phases of aerodynamic development and the development, or planned development, of materials and equipment for future aeroplanes. If a design were frozen on current practices the aeroplane would be obsolete before it could be produced.

A typical medium sized airline engineering organization is shown in Fig. 1. No two airlines are alike. However, regardless of what the various persons are called or how they are organized, the airlines in general have the same diversity in engineering requirements.

Although not within the scope of this paper it might be of interest to mention that one of the most outstanding features of airline engineering is the complete co-operation that prevails between all of the airlines on this continent. Anything that one airline develops or uncovers is gladly given to any other airline for the asking. It is this spirit of " one for all and all for one " that is in a large measure responsible for the great strides that the airlines in the United States and Canada have made during the past decade.

Present Status of Aeroplane Manufacturer's Engineering

Certain manufacturers, who had just completed the design of large passenger aeroplanes before the war, have converted these aeroplanes into military transports. Other manufacturers have since designed large aircraft strictly for military transport work. Both types of aeroplanes are of such a basic design that they can be used for commercial services in the immediate post-war period providing it is recognized that they are " stop-gaps ".

No one has been able to devote engineering time to the design of a strictly commercial airliner incorporating current ideas on the subject, many of which have been obtained as a result of experience gained on military transport services.

The knowledge gained by the manufacturer's engineering staffs during the war concerning aerodynamics, materials and production methods has been great. The knowledge that they have gained relative to the fulfilment of the modern concepts of airline operations is, unfortunately, practically nil.

The manufacturer's young engineers have the ability, however, to design practically anything that is asked of them. It is, therefore, up to the airline to tell them what is needed.

In the meantime the only aeroplanes that are available for immediate post-war use are aeroplanes that are being used at present, or designed, for military transport work. This point must be kept in mind during the remainder of the discussion.

Because the end of the war does not appear to be too far away, the airlines have recently prepared specifications covering the alterations they will require to permit the use of the military transports on commercial services. Many items in these specifications will undoubtedly be adopted almost immediately by the manufacturer because they will also increase the efficiency of the military version of the aeroplanes now in production. Fortunately for the airlines this will greatly accelerate the reconversions and modernizing of the aeroplanes for commercial services after the war.

It might be mentioned that an aeroplane basically designed as a bomber cannot be successfully converted to a transport because the objectives are fundamentally different. The most successful military transport aircraft now in wide use have all been designed originally for commercial operations so they can be readily reconverted and used by the airlines until the real post-war designs are developed.

Establishment of Policy

Let us now consider the various stages leading up to the selection of a new aeroplane by the airline.

When it is believed opportune to consider the purchase of a new type of aeroplane, persons charged with the task must first step outside their normal duties and review a few fundamentals. Their selection of aeroplane and arrangement of equipment within it will depend upon this foundation. Most airlines will find that they have been so busy trying to give their country the maximum possible service that there are many basic policies that have not been brought up-to-date for several years.

It must first be established whether or not the airline is to supply a service on a provincial, a national or an international scale. Is it to serve the group of people who are now using air travel or is it to endeavour to serve the greatest possible number in any community? Is it to provide a fast long distance "express" service, a medium speed "local" service, a short haul "feeder" service, or shall it provide the integration of all three? Is it to specialize in the carriage of passengers, or mail, or cargo, or what combinations of the three?

Typical Airline Engineering Organization

SUPERINTENDENT OF ENGINEERING

Assistant Superintendent of Engineering (Headquarters)
- Engineering Coordinator
- Chief Draftsman
- Chief Clerk
- Supervisor of Aircraft Engineering
  - Aircraft Specifications Engineer
  - Performance & Operations Engineer
  - Manufactures Liaison Engineer
  - Interior Accommodation & Removable Equipment Engineer
  - Aircraft Structural & Fixed Equipment Engineer
  - Materials & Processes Engineer
    - Junior Engineer
  - Economic Research & Weight Control Engineer
    - Junior Engineer
- Supervisor of Radio and Electrical Engineering
  - Ground Station Radio Engineer
    - Junior Engineer
      - Draftsmen
  - Aircraft Radio Engineer
    - Junior Engineer
      - Draftsmen
  - Electrical Engineer
    - Junior Engineer
      - Draftsmen
  - Instruments Engineer
      - Draftsmen
  - Radio & Electrical Development Engineers
    - Technicians
      - Draftsman
- Supervisor of Plant and Equipment Engineering
  - Buildings Engineer
    - Building Inspector
      - Draftsmen
  - Equipment Engineer
    - Automotive Technician
  - Mechanical Engineer
    - Tool Designer
      - Draftsmen
  - Electrical Engineer
  - Safety Engineer
- Supervisor of Airways Engineering
  - Airways Engineer
    - Surveyors
    - Junior Engineers
      - Draftsmen

Assistant Superintendent of Engineering (Operations)
- Engineering Coordinator
- Chief Clerk
- System Supervisor of Engineering (Domestic Services)
  - Aircraft Project Engineers for Service & Repair Liaison
    - Draftsmen
  - Aircraft Project Engineer for Production & Overhaul Liaison
    - Draftsmen
  - Power Plant Engineers
  - Radio & Electrical Engineer
  - Plant & Equipment Engineer
    - Draftsmen
  - Senior Draftsman
  - Weight Control Clerk
- Supervisor of Engineering (Trans-Atlantic Division)
  - Aircraft Projects Engineers for Service & Repair Liaison
    - Draftsmen
  - Aircraft Projects Engineer for Production & Overhaul Liaison
    - Draftsmen
  - Power Plant Engineer
  - Radio and Electrical Engineer
  - Plant and Equipment Engineer
    - Draftsmen
  - Senior Draftsmen
  - Weight Control Clerk
- Do. for Other Divisions

Fig. 1

These engineers will also have to recall to mind that the objective of any airline in peace time is to provide a considerably faster means of transportation than any other available, and still make a profit. At the same time, it wishes to provide greater regularity and comfort than any other airline in order to attract a fair share of the business to itself. All airlines wish the ultimate in safety for each other and help each other to attain it.

The next objective is to provide this service as economically as possible to the greatest number of people who might desire to use it.

The final objective, and one associated with a government-owned airline, is to provide a service as inexpensive as possible to locations which would benefit the country as a whole although not necessarily economically sound insofar as the airline itself is concerned. Such services may be desired either from the standpoint of overall trade that could result to the country or for reasons of national defence.

A review is then made of the services that are definitely planned for the airline. Mileages between stations and to alternate airports are tabulated. A profile of the entire airway is plotted showing altitudes of airports, gradients required to clear obstructions when climbing out of any runway on the airports, and heights of land or obstructions along the airway with a distance of ten miles on either side of the centre line of the airway. Average and extreme wind velocities with directions at different altitudes along the airway are studied. A review is made of the frequency and intensity of icing conditions that will be encountered and the altitudes that must be flown to miss these conditions as much as possible. The length, direction, gradient and type of all available and planned runways are tabulated along with prevailing ground wind velocities and directions. This survey is extended to include additions to the routes that may be expected within the next five or ten years.

The next survey concerns the traffic that might be expected, and is, unfortunately, the weak link in the chain of facts that dictate the design of the required aeroplane. Many estimates have been made of the likely growth of airline traffic within the next few years. Although made by persons with many years of transportation experience, they vary so much that they are next to useless. We believe that it is impossible to predict post-war traffic on the basis of its growth prior to the war. Certain features are being, or will be, incorporated in the design of future aeroplanes that will reduce their operating costs considerably. This in itself would open up an entirely new field of potential traffic.

It is felt that a brief review of the various areas in the country on a basis of population, per capita wealth, money invested in industry, total mail traffic for the area, perishable goods traffic and its tourist attraction, would give at least as good an indication as any of the domestic routes that may be desired, or required in the future. A somewhat different review is required in relation to foreign services because some foreign services could result in a loss to the airline but a gain to the country. The actual weight of the traffic that might be carried over these routes can only be rough estimates based on past experience and beliefs in future potentialities. The problems of schedules and frequency of services both have an influence on the characteristics of the aeroplane to be purchased although they usually do not receive the attention they should in the preparation of the specification.

It might seem unfortunate that such a vital and fundamental thing as the size of the aeroplane needed to accommodate the estimated traffic should be based on such unscientific evidence, when the remainder of the whole problem of design is thoroughly engineered. It is not as bad as it looks. The fuel required for trans-Atlantic or transcontinental express services will dictate the minimum possible size of the aeroplane assuming that it will carry at least twenty persons because the wings must be large enough to hold all the required fuel. The size of the aeroplane designed with this minimum wing size fortunately gives us an aeroplane that appears most reasonable for the immediate post-war period in Canada. In fact it is felt that it is the ideal size to use until the real post-war aeroplanes are developed and until actual experience is gained with post-war traffic potentialities.

Selection of Aeroplane and Preparation of Specifications

Some airlines maintain a running specification of the type of aeroplane and equipment they would like to have at any time. As new desirable devices appear on the market they are included in this specification and their respective predecessors are removed. It is realized at the time that many of the things contained in this running specification are not compatible with each other but they all represent what is believed to be the best piece of equipment in its own field. This is done because when the compromising starts with the manufacturer it is better to commence with as many first choices as possible and weed out as few as possible.

After establishing matters of policy and being familiar with the features of " the ideal but impossible to attain aeroplane " from the running specification, the next step is to visit the various aeroplane manufacturers.

It has been found from experience that it is completely unsatisfactory to stay at home and be visited by representatives of the aeroplane companies. The required amount of information can never be obtained this way. It has been found by experience that the only way to obtain an accurate picture of the situation is to spend several days, or weeks if necessary, with the manufacturer's engineering department and in the factory.

The airline representative must become completely familiar with every item that has been used in making up the manufacturer's weight estimate. Invariably there are many items of equipment that an airline must have because of the nature of its own operations which are omitted from the manufacturers weight break-down. As a result of this review it will generally be found that the possible pay-load of the aeroplane will not be as great as originally quoted. It might be mentioned that this is a common occurrence because the manufacturers contend that they only include the bare necessities that would be common to all airlines and then leave it up to the individual airlines to add whatever equipment they wish.

Unfortunately, such an aeroplane with the minimum possible equipment will usually be able to fly faster than when it is fully equipped with all its radio antennæ and other accessories. A review of the manufacturer's entire performance estimate is therefore required in order to ascertain the practical performance figures that will be attained when the aeroplane is placed in airline service.

Because of war necessities, most military transport aeroplanes are flying with loads far in excess of those which could be carried in peace-time and meet Civil Airworthiness Requirements. A review is therefore required of the structural strength factors and take off and landing characteristics to determine the actual status of the aeroplane insofar as its ability to meet Civil Airworthiness Requirements is concerned. This review will also indicate the possibility of the permissible gross weight being increased at some future date by the expenditure of a small amount of weight in strengthening certain members. This information is also desired in order to be forewarned of possible increase in power that would be required to look after an increase in gross weight.

The designs of the aeroplanes under consideration are then studied qualitatively from the standpoint of ease of servicing and maintenance, their robustness and their suitability for the job they will have to do. The suitability and ease of servicing and maintenance covers a tremendous field of investigation but at this stage the investigation is of a preliminary nature to assure that there are no features badly out of line with the airline's requirements. The more comprehensive investigations of suitability and maintenance facilities are made later during the preparation of the Detailed Specification.

A comparative analysis is next made of the data collected for the aeroplanes that appear to have the best potentialities for the particular requirements of the airline, and a tentative selection is made.

The selection is tentative because there will undoubtedly be many features that the airline will want changed and the final decisions to purchase the aeroplane will in no small measure depend upon the cooperative attitude displayed by the respective aeroplane manufacturers.

The airline will next investigate the practicability of making the changes that appear desirable. Some of these investigations may consist merely of verbal discussions with the aeroplane and equipment manufacturers, others may involve many hundreds of hours of investigation by the airline's engineers. An example of the latter would be the case where the airline wanted a different power plant from the one originally planned by the manufacturer. The method of conducting such an investigation will be discussed later.

As soon as a clear understanding and agreement exists between the airline and manufacturer as to what can be given to the airline, the manufacturer prepares a relatively brief Basic Type Specification covering the fundamental features of the aeroplane that can be built for the particular airline.

Using this specification as a basis, the airline may then prepare a Detailed Type Specification covering every departure that the airline requires from the aeroplane currently in production or as originally planned by the manufacturer. To make the specification stand on its own feet it also includes a description of the standard features of the aeroplane. This Detailed Specification will be a compromise between the airlines idea of an ideal aeroplane and the one the manufacturer would have preferred to supply because of his aversions to changes from his standard production model.

The preparation of this Detailed Specification, if done thoroughly, will be of great value to the manufacturer who cannot help but acquire many new ideas from it. Although it will require many thousands of engineering hours it will, by being included in the purchasing contract, ensure that the airline gets exactly what it finally agreed to accept.

It is common practice for the airline to maintain a liaison engineer at the manufacturer's plant throughout the construction of the aeroplanes. The main duty of this engineer is to ensure that the airline's Detailed Specification is interpreted correctly and to advise the airline immediately of any departures from the specifications that are believed necessary

One of the greatest problems with which the airline has to contend is the freezing of the Detailed Specification. There will hardly be a day from the time the selection of the aeroplane is made until it is delivered, that some manufacturer does not bring to the attention of the airline recent improvements in his products. For instance, an investigation will be made for the selection of a hydraulic pump by obtaining the latest data from all the leading accessory manufacturers. The selection of the pump will not have been made one month before one of the manufacturers, whose pump was not selected, will either modify his product or bring out a new design to make it at least appear more desirable than the pump chosen. If the airline were to change its Detailed Specification on every such occasion, the aeroplane manufacturer would never be able to order the parts and build the aeroplane. On the other hand, it is extremely difficult to refrain from making such changes. Dates must be set by the manufacturer after which changes are not permitted.

Another problem, more serious to the airline, but this time to the embarrassment of the manufacturer, is the changes in the plans of the aeroplane manufacturer by order of the military authorities. These continual changes are rightfully made in order to meet higher priorities resulting from the military situation. As a result, however, the Detailed Specification will remain in an extremely fluid state and be even more of a compromise because the manufacturer is only permitted to devote engineering time to items of direct benefit to military contracts.

Features Reviewed During Selection of Aeroplane and Preparation of Specification

General

In order to better understand the selection of any airline aeroplane, a few of the fundamentals involved will now be reviewed.

It was mentioned previously that the designs of the various aeroplanes under consideration are studied for their suitability. By this is meant that each aeroplane is examined from the viewpoint of it being able to perform the particular service required by the particular airline.

A universal purpose aeroplane does not exist. If an aeroplane is designed specifically to do one job it cannot do another as well. Unfortunately, no two airlines operate under the same conditions so the manufacturer must, of necessity, build the compromise aeroplane that he believes will be most acceptable to his biggest customers. Each airline must, therefore, determine if the aeroplane as designed by the manufacturer is suitable for it. If the design is not suitable in all respects it must then be determined whether or not the aeroplane can be modified in a way that would make it acceptable.

The interior arrangement and much of the equipment used in an aeroplane can be altered to suit each

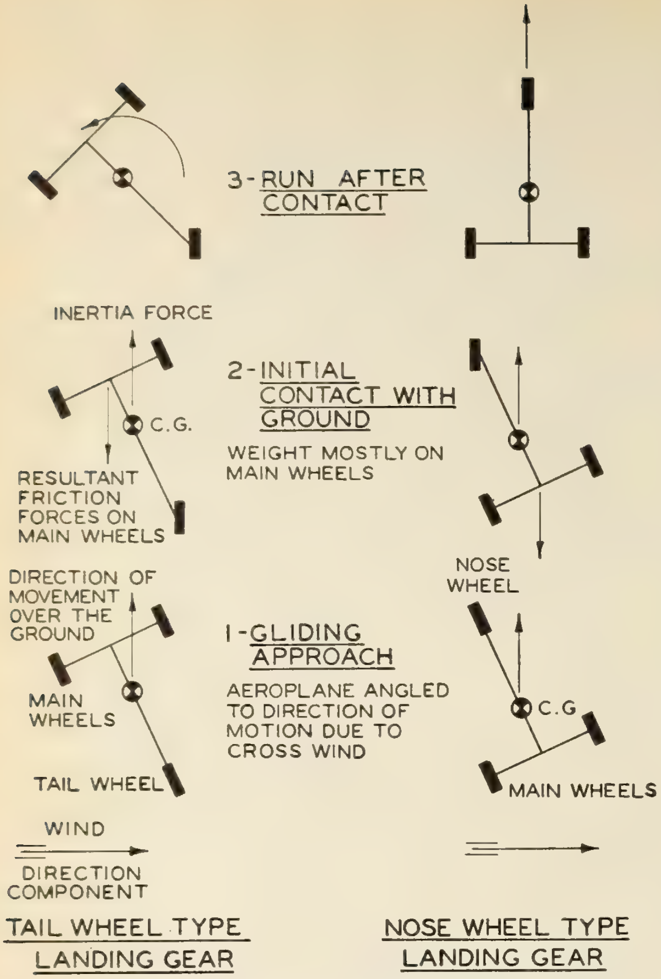

Fig. 2—Diagram showing comparison between operation of tail wheel and nose wheel types of landing gear.

customer so these features will be discussed later. Other features not as easily altered are, therefore, examined first.

STRESSED SKIN STRUCTURE VS. INTERNAL STRUCTURAL SKELETON

It should go without saying that an all metal stressed skin monoplane is desired. By stressed skin is meant that the metal covering of the aeroplane carries a considerable portion of the loads imposed during flight or on landing as against the skeleton type where all the loads are carried by an internal structural framework. The stressed skin type of construction, by having the material concentrated at the extreme fibre, has a much higher strength/weight ratio. Because of the wide climatic changes encountered by airline aeroplanes, a metal covering is preferred to a wooden covering.

LOW WING VS. HIGH WING

There has been considerable controversy between designers and operators as to whether the wing should be located at the top of the fuselage or below the cabin floor.

The high wing position is better aerodynamically, better for loading and unloading, better for the passengers' view, but it landing gear is generally heavier and it does not protect the passengers as well in the event that the aeroplane has to be ditched at sea or to alight with the wheels retracted on land. The high wing position also considerably handicaps the interior arrangement because of the restricted head room near the mid length of the fuselage. Considering the pros and cons of each, the low wing position is generally preferred.

NOSE WHEEL VS. TAIL WHEEL

Another fundamental feature of design that was controversial for a short time was the location of the third wheel in the landing gear. It is now generally conceded that the nose wheel is here to stay. It greatly facilitates loading as the cabin floor remains level when the aeroplane is on the ground instead of having a slope of from 12 to 14 deg. that results from the use of a tail wheel. Another important advantage of the use of a nose wheel is that it permits more than 30 deg. out of wind landings to be made in wind velocities of 20 m.p.h. Since it is unsafe to land out of wind by more than about 20 deg. with a tail wheel type of gear, an airport for the latter would have to have runways in four directions. A triangular runway system would be sufficient for aeroplanes with nose wheels so a saving of 25 per cent in airport runway costs is thereby effected. Figure 2 illustrates why the tricycle type of landing gear is stable in a cross wind landing while the tail wheel type of gear is unstable.

FOUR ENGINES VS. OTHER COMBINATIONS

The third fundamental feature which has also been controversial is in relation to the number of engines with which an aeroplane should be equipped. The advantages of using four engines instead of two or three or a larger number are at the present time so great that the four-engined transport has become the universally accepted type. The two-engined aeroplane becomes worthy of consideration only if its design permits the sudden stoppage of one engine at any time from the commencement of take-off without the aeroplane swinging appreciably.

SAFETY

The first thing that actually requires an engineering investigation is in relation to safety. It must be assured that the maximum safety that is practical will be attained with the aeroplane under consideration.

The structure of an aeroplane is subjected to forces resulting from its normal manœuvres and from encountering turbulent air conditions. The greater the acceleration developed in the manœuvres the greater will be the loads imposed upon the aeroplane. The stronger the aeroplane is made to accommodate these forces, the greater will be its structural weight in relation to the fully loaded weight with which it can fly; and so the less the quantity of useful load it will be able to carry.

For instance, a fighter which is frequently subjected to violent manœuvres while encountering an enemy must be very strong, so it is able to carry relatively little equipment or useful load. A cargo carrying aeroplane, on the other hand, must be able to carry a large useful load. This is accomplished by making the aeroplane of lighter structural weight and by restricting the type of manœuvres to which the aeroplane may be subjected. It will be seen that this can be carried to the extreme where the maximum cargo could be carried if the aeroplane were only permitted to be flown very steadily in calm air.

The Government knows from experience what forces an aeroplane is likely to encounter at some time during its career and, by regulations, ensures that the aeroplane will be able to encounter these forces with safety. Government regulations, therefore, have been set up to ensure that both the structural strength, the flying characteristics, and the aeroplane performance will be satisfactory for the type of forces that will normally be encountered on the particular operations for which the aeroplane is designed.

Because of a certain amount of deterioration with age and the encounter of isolated loads on the structure more severe than normally expected, a margin of safety for its structural strength is also required by the regulations. The attainment of this margin of safety will, of course, reduce the useful load which the aeroplane could otherwise carry.

It is generally considered that this margin of safety need not be as high on military operations as on commercial operations because of the general need for the maximum possible useful load and the relatively shorter life in military service. A commercial airliner can never be considered to be expendible whereas the loss of a certain percentage of military aircraft can be permitted in view of the objective to be attained. The cargo load that an aeroplane carries on military missions is, therefore, not necessarily an indication of what it would be permitted to carry on a peacetime commercial service.

In considering the possibility of using a military transport aeroplane on post-war commercial operations, the entire structural strength characteristics and flight characteristics of the aeroplane must be investigated as previously mentioned.

SPEED

After safety, speed is probably the most important feature.

The next objective that is considered in the selection of an aeroplane is, therefore, speed, for speed is the primary asset that air travel has to offer, compared with other transport services.

Speed does not mean the maximum velocity attainable by the aeroplane but the net speed resulting from the total elapsed time that is taken by the passenger or goods to go from Point A to Point B. The speed in flight must also be attained with the use of engine powers compatible with economical operation.

Just as a compromise had to be made between the strength and load carrying ability of the aeroplane, a compromise must also be made between speed and both load carrying ability and economy of operation. The greater the speed, the greater the power required, assuming the aeroplane is already well designed aerodynamically. The greater the power the greater the weight of the power plant and fuel required for any specified range, and so the less the useful load that can be carried. Similarly, the greater the power, the greater the fuel consumption and so the higher the cost of the operation.

The speed that is considered satisfactory for a commercial service will, therefore, be as low as possible consistent with the demand of the users of the service. This will depend to a considerable extent, upon the speed of rival transport services over the same route. For example, an aeroplane flying into the north country in competition with canoes and horses, need not have the speed of an aeroplane on a trans-continental service in competition with fast trains and other airlines. An instance of this is that a group of airlines in the United States have only recently revised their plans and ordered another type of aeroplane because one airline demonstrated that it could provide a faster trans-continental service than the first group had originally planned to give.

Consideration must, therefore, be given to the overall speed that can be provided by competing airlines or railways.

Certain features of the aeroplanes being compared are noted by the airline in order to form an opinion of how efficient the designer has been in attaining his speed. These factors include aerodynamic cleanliness with the aeroplane in the normal attitude for cruising flight; thrust horsepower available at the planned cruising altitude; cooling drag; thrust recovery from the exhaust; aerofoil characteristics; wing characteristics; and possible interference drags from fillets, antennae and other excrescences.

Features to facilitate rapid servicing, loading and unloading and replacement of parts giving trouble are of the greatest importance in their contribution towards the overall speed of the trip. For instance, forty minutes could be saved between Edmonton and Montreal by merely cutting five minutes off the time spent at each of the present stops on the T.C.A. schedule.

It is unfortunate that the larger the aeroplane the larger will likely be the time required at a station for servicing unless radical improvements are made in the design of transport aeroplanes. Mr. J. T. Bain has covered this very completely in his paper " Principles Involved in a Modern Concept of Airline Operation ".

The time spent in an automobile going to and from the airport while detracting from the overall speed attained, is outside the control of the airline designer.

SIZE

The size of an aeroplane for any particular number of passengers or quantity of cargo contributes greatly to the speed, economy and comfort of the aeroplane.

It is a matter of basic policy to decide whether the aeroplane is to have a *Queen Mary* cabin, or one purely " functional ", or one in between.

A bomber is generally designed with a fuselage of the minimum size necessary to house its bombs, crew and armament.

A cargo aeroplane, on the other hand, will have a large fuselage and large heavily framed loading doors to accommodate large pieces of cargo, but it will generally have little sound proofing, heating and ventilating equipment and no cabin supercharging.

An airline aeroplane, representing still another type, must be able to accommodate its payload conveniently in any combination from all passengers to all cargo. This involves provisions entirely different from either a bomber or purely cargo aeroplane. The difference is particularly marked in view of the desire to segregate the mail and air-express in accordance with its destination to ensure quick handling at each station.

Because two or four is company but three is a crowd, the best seating arrangement appears to be to have the majority of chairs arranged in pairs, facing forward, on either side of a centre aisle. It is also desirable to have a certain number of compartments wherein one pair of seats face forward and the pair immediately ahead face aft. Because of the desire to reduce the average seat occupancy over the airline from its present 90 to 65 per cent, there would generally be space to permit a traveller to be alone if he so wished. This objective might require clarification. In order that passengers may be able to obtain a seat whenever they wish, it is desirable that there be a sufficiently frequent service or large enough aeroplanes that only about 65 per cent of the seats will be filled

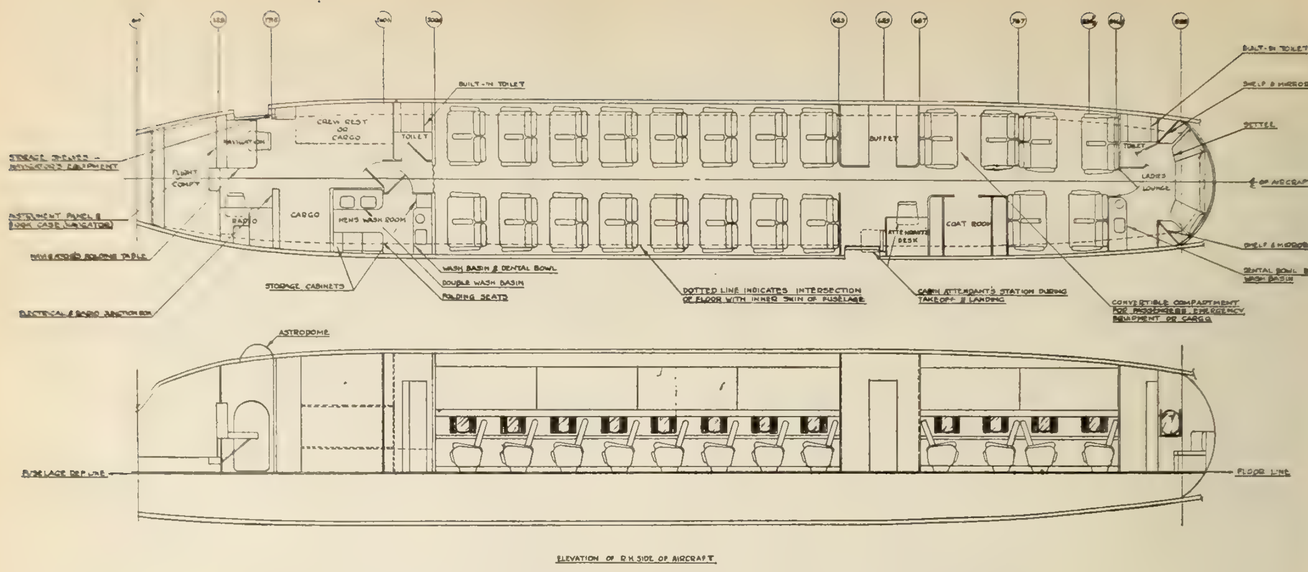

Fig. 3—Plan and longitudinal section of typical fuselage interior.

as an average over all routes. It is of course, desired to always fly with the maximum possible payload which would be attained by carrying more cargo.

Having decided upon the transverse arrangement of seating and having decided that the cabin will be kept as small as possible consistent with reasonable comfort, the diameter of the fuselage becomes relatively restricted. Four persons are just so wide and the aisle need be no wider than to permit two persons to pass each other comportably. The width of the aeroplane will, therefore, be between 11 and 12 ft. Since the height from the floor to the ceiling need only be around 7 ft., a completely circular fuselage would be undesirable because there would be insufficient space below the floor to accommodate cargo and there would be too much to waste by not using it for cargo. Because a circular cross section is required from a strength/weight standpoint with a pressurized fuselage, it becomes necessary to make up the cross sectional shape from two segments of circles, one above the floor to house the passengers and the other below the floor to house the cargo. The floor, therefore, does double duty by also acting as a transverse tie rod to prevent the sides at the intersection of the two circles from bulging at high altitudes.

The length of the cabin would depend upon the number of persons it is desired to accommodate. It is preferable that this number be a multiple of eight in order that all seats may be used in converting them into berths. Four seats are combined to form one lower berth, the upper berth folding out of the wall somewhat similar to that on a Pullman.

The Californian aeroplane designers rarely make adequate provision to accommodate Canadian winter clothing so this point must be considered in relation to the cabin length.

It is also very desirable that space be provided in the cabin to permit passengers carrying small hand bags on board with them to store them unchecked in an accessible rack.

The length of the fuselage required is further governed by space to accommodate the ladies' and gentlemen's dressing rooms and toilets; the galley; the cabin attendant's station; and, on trans-oceanic aeroplanes the crew's rest room, the radio operator's station and the navigator's station.

Figure 3 illustrates a typical fuselage interior. The station numbers refer to the number of inches the respective station is located aft of the nose datum.

HIGH ALTITUDE PERFORMANCE

An aeroplane should be able to cruise at an altitude of 30,000 ft. and be sufficiently protected against icing to permit it to climb through an icing condition to that altitude if a reliable service is to be operated throughout the year over the North Atlantic. Such an aeroplane is not yet available although satisfactory designs soon will be. Aeroplanes selected for the North Atlantic service today should be able to cruise at least at 25,000 ft. altitude. In the meantime, weather delays will remain more numerous than desired for a scheduled operation.

Apart from the desire to either get above an icing condition or select any desired altitude to miss it, the ability to fly at high altitudes has many other desirable features.

The most important is undoubtedly the greatly increased speeds attained for the same horsepower because of the reduction in air density and hence reduced drag at the high altitudes. For instance, an aeroplane will fly about 50 per cent faster at an altitude of 25,000 ft. than at sea level if the same power is maintained. This advantage is two-fold. By flying faster, more trips can be made in any period of time. The loss in payload that accompanies the installation of high altitude equipment can, therefore, be compensated for by the gain in payload resulting from the additional services operated.

On certain services, advantage can also be taken of high prevailing tail winds at high altitude.

The ability to fly at any altitude up to at least 25,000 ft. also permits the captain to select the most comfortable level for the flight in relation to turbulent air.

PRESSURIZED FUSELAGE

A pressurized, or supercharged fuselage is essential for high altitude flying. Passengers will refuse to wear oxygen masks if any other means of flying above 10,000 ft. without using them is available.

An aeroplane must be designed for pressurizing from the start as it is a feature that cannot be incorporated later. The requirement of a fuselage with a circular shaped cross-section has already been mentioned.

It is desirable that the structural strength of the fuselage be such as to permit the pressure within the cabin to remain equivalent to an altitude of 8,000 ft., when the aeroplane is actually at an altitude of 25,000 ft. The average person does not require oxygen until he goes above 10,000 ft., hence the limit of 8,000 ft. to take care of persons with lower altitude resistance than the average.

The use of a pressure cabin has other assets. It permits the aeroplane to descend through icing or turbulent air conditions at a high rate of descent while the pressure in the cabin can be increased more gradually so as not to affect the ears of the passengers.

WEIGHT AND PAYLOAD

A weight investigation is next conducted for the various combinations of aeroplanes and engines under consideration.

The primary object of this investigation is to determine the disposable load that will be available with the different combinations.

From this information and the determination of the fuel and oil required for the various flight conditions, the possible payload of each combination is calculated.

One of the most important factors in the selection of any aeroplane-engine combination is its payload for the ranges it must fly. From this information and the estimated frequency of service originally decided upon, the pound-miles of payload that could be carried in a year is established. This, when used with the operating cost estimate, gives the cost per ton mile of payload which is one measure of the efficiency of the design of the aeroplane.

A secondary objective of a detailed weight breakdown is to provide comparative information on the different aeroplane-engine combinations so that the performance calculations may be restricted to a minimum number of combinations as quickly as possible.

The third objective is to provide a break-down of system and component weights so that any departure from the existing estimates may become quickly known during the manufacture and subsequent alterations to the aeroplane.

It might be noted that from a weight standpoint it would be desirable to have all factors of safety exactly 1.0 with the factored loads applied. The closer this is achieved, the greater will be the payload. However, if such were the case, there would be many maintenance headaches because strength alone does not always establish the criterion for serviceability. Many items must be stronger than actually required by government regulation in order to stand up for long periods of service with the continual vibration they will experience.

FUEL CAPACITY REQUIRED

The preliminary study of route mileages, distances to alternate airports, wind velocities and weather conditions, gives an approximation of the minimum acceptable range which the aeroplane must provide.

An extensive investigation must be conducted into the whole situation for each combination of aeroplane and engine under consideration.

Allowances for the fixed quantities of fuel must first be determined. These include fuel for taxiing out to the runway, warming up and checking the engines, taking-off and climbing to 1,000 ft., manoeuvring at 1,000 ft. on the approach to the airport, descending below 1,000 ft., and taxiing in to the ramp.

Fuel consumption curves are obtained from the engine manufacturer showing the fuel consumption in pounds per brake horsepower per hour against brake horsepower for various manifold pressures and fuel air ratios. The fuel consumption in gallons against brake horsepower is also plotted for various RPM.

Fuel consumptions and ground distance covered are then calculated for climbs and descents at different rates between altitudes from 1,000 ft. above the ground to the aeroplane's ceiling. This is done at different gross weights.

The various types of cruise controls that may be used are next calculated for each combination of aeroplane and engine at different altitudes and with various headwind components. Curves of miles obtained per pound of fuel consumed vs. indicated airspeed are plotted in increments of gross weight. See Fig. 4.

Curves of brake horsepower required are also plotted to tie in weight and speed. The speed for the maximum lift/drag ratio and the speed for ten per cent in excess of that for maximum lift/drag are plotted. The miles per pound peaks for the various weight curves are joined by a line which can be called the optimum speed curve. The best operating speed curve is then plotted by joining the respective miles per pound point on each weight curve which gives a faster speed than the optimum speed curve but which produces one-half of one per cent less miles per pound of fuel than the optimum speed condition. That is the flight may be flown considerably faster with a negligible reduction in the miles per pound of fuel consumed.

A decision may then be made by examining the

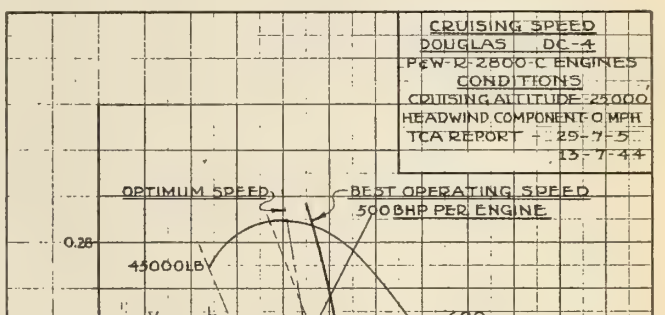

Fig. 4—Curves of miles obtained per pound of fuel consumed vs. indicated airspeed for the Douglas DE-4.

curves of the type of cruise control that it would be best to follow. The choice would be between

Optimum indicated airspeed.
Best operating indicated airspeed.
Speed for maximum Lift/Drag.
Constant indicated airspeed.
Constant power.

If it is desired to operate the service at as high a speed as possible consistent with reasonable fuel economy, the optimum speed control or its simpler version, the constant indicated airspeed control, would be the choice.

If the aeroplane under consideration has marginal fuel capacity, it would be better to adopt the constant power control.

Range analysis charts are next prepared.

Fuel consumptions are calculated for cruising at various altitudes, at various speeds and at different gross weights.

The effect of headwind and tailwind components of different magnitudes are then inserted.

Values for the following curves are calculated and plotted:

True airspeed vs. rate of climb at the indicated airspeed and power for best rate of climb.

Rate of climb vs. altitude at the indicated airspeed and power for best rate of climb.

Average true airspeed vs. range for particular take-off weights, cruising altitudes and head wind components.

Average ground speed vs. range for particular take-off weights, cruising altitudes and head wind components.

Block-to-block speed vs. range for particular take-off weights, cruising altitudes and head wind components.

Cruising time vs. range for particular take-off weights, cruising altitudes and head wind components.

Block-to-block time vs. range for particular take-off weights, cruising altitudes and head wind components.

Instantaneous BHP per engine at cruise vs. range for particular take-off weights, cruising altitudes and head wind components.

Total fuel consumed block-to-block vs. range for particular take-off weights, cruising altitudes and head wind components.

Average ground miles per lb. fuel in cruise vs. range for particular take-off weights, cruising altitudes and head wind components.

From these, the total fuel required is obtained for any range. See Fig. 5. The fuel capacity of the aeroplane under consideration is compared with the fuel required for the worst case and its suitability determined.

OPERATING COST

The economy of operation of a fleet of aeroplanes is naturally one of the most important factors to be studied. An airline company must pay its way in some manner or it will not survive.

In general, the selection of one aeroplane instead of another of a similar type will not affect the indirect operating costs so that, when comparing the economies involved with different aircraft, it is usually the practice to study direct operating costs only.

The selection of an entirely different type of aeroplane from one previously used can, however, greatly affect the indirect costs. For instance, the ground facilities required for the operation of aeroplanes carrying forty passengers are vastly different from those required to operate aeroplanes that carry only fourteen passengers.

There are usually so many contradictory factors involved in every service considered, and in every

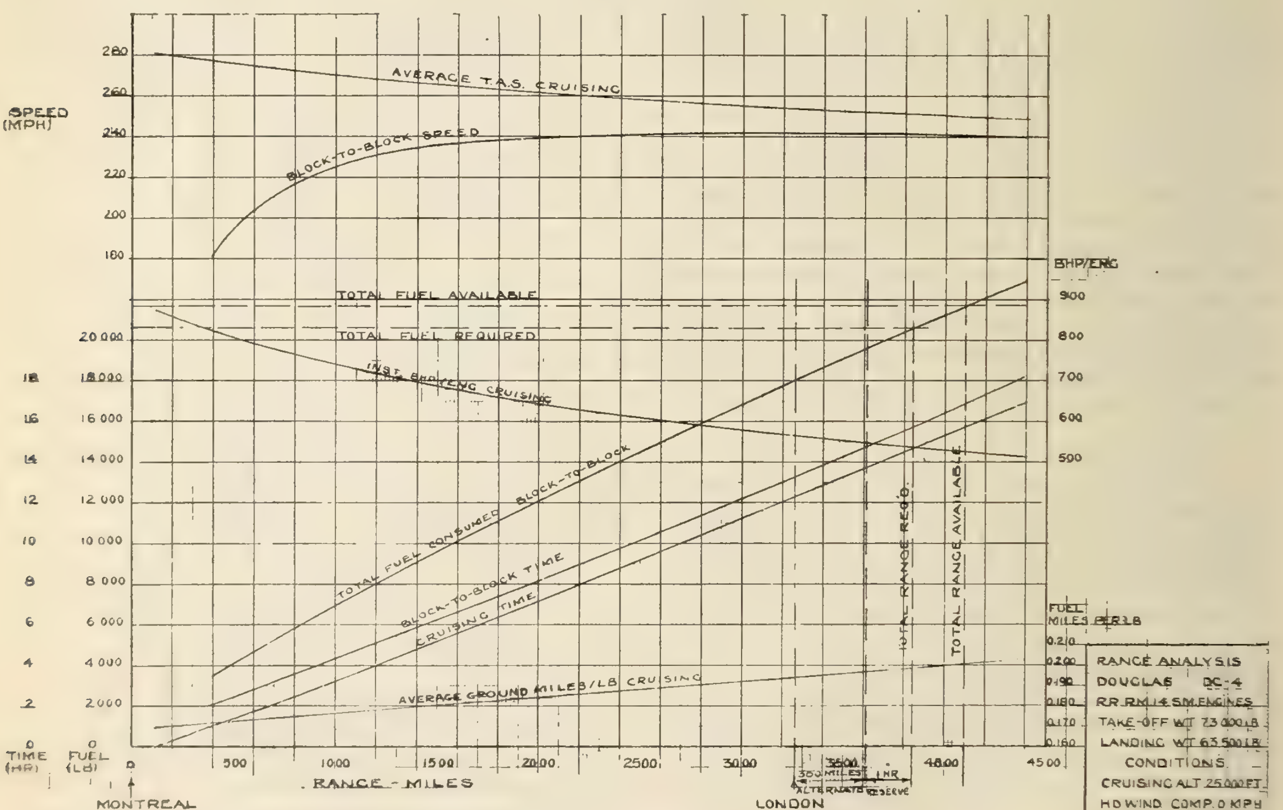

Fig. 5—Range analysis charts for the Douglas DE-4.

aeroplane design, that it would be pure luck to obtain any accuracy in an estimate of operating costs without a comprehensive quantitative analysis.

W. C. Mentzer and H. E. Nourse of United Airlines made an extremely valuable contribution to the industry by their analytical study of operating costs and the development of suitable formulæ for estimating such costs. Their cost per operating mile formulæ have been amplified recently by those of the American Air Transport Association.

C. A. Hangoe of Trans-Canada Air Lines has just completed a study wherein he has developed cost per hour formulæ more suitable for the Canadian operator after first considering in each instance the adaptability of American formula to Canadian airline conditions.

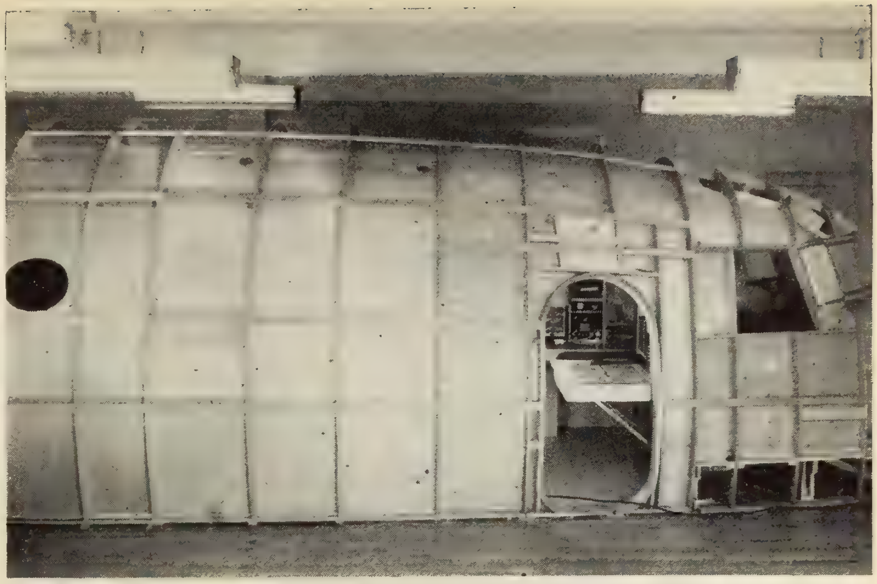

Fig. 6—"Mock-up" containing flight compartment and men's dressing room.

A cost per hour analysis is therefore made for various ranges, cruising conditions and engine-æroplane combinations in order to obtain comparative costs for operating the aeroplanes each mile of the different routes, and also the cost of carrying a ton of pay-load for each mile over these routes.

Various so-called efficiency factors have been suggested for comparing the cost of operating different aeroplanes. One such factor is the ton-miles per hour per horsepower and another the ton miles per hour per horse-power per pound of weight of the aeroplane.

The direct operating costs per hour have been broken down into the following groups and a formula developed for estimating the value of each:

Flying personnel salaries, including pilots in training.

Flying personnel supplies and expenses.

Aircraft engine fuel.

Aircraft engine oil.

Passenger supplies and expenses.

Aircraft servicing, labour and supplies.

Aircraft overhaul and repair, labour and supplies.

Aircraft propeller overhaul and repair, labour and supplies.

Aircraft instrument overhaul and repair, labour and supplies.

Aircraft engine overhaul and repair, labour and supplies.

Aircraft communications equipment overhaul and repair, labour and supplies.

Miscellaneous flying equipment repair, labour and supplies.

Flying equipment insurance.

Liability and property damage insurance.

Employees liability, flight risk and injuries to public and property damage insurance.

Aircraft depreciation, including instruments and spares depreciation.

Propeller depreciation, including spares depreciation.

Aircraft engine depreciation, including spares depreciation.

Aircraft communication equipment depreciation, including spares depreciation.

Miscellaneous flying equipment depreciation, including spares depreciation.

Other flying expenses, items unable to classify as one of the above.

POWER PLANT

The selection of the engine for the aeroplane is another one of the major decisions that must be made by the airline. Undoubtedly the aeroplane manufacturer has very good reasons for choosing the engine he did but this engine may or may not be the most suitable for a particular airline.

This war has amply demonstrated that no country has a monopoly on engineering ability. If an airline is to obtain the best possible combination of engine and aeroplane for its particular services it must investigate all aeroplanes and all engines available regardless of their country of origin.

In their choice of engines in the past, it is doubtful if any of the United States airlines have seriously investigated the possibilities of using engines manufactured in other countries, although it is freely admitted that foreign engines to be selected would have to be very much more suitable in some respect than domestic engines. An airline that fails to make such an investigaion, however, may seriously handicap its operation.

Before starting the investigation, the conditions prevailing on the various routes to be operated are reviewed and the governing condition, or conditions, chosen. In the case of the routes that Trans-Canada Air Lines expect to operate after the war there appeared to be two conditions sufficiently different from each other that it was believed two different engines would be required. One set of conditions prevailed over the North Atlantic and another over the remainder of the planned routes. Because the North Atlantic conditions are more difficult to meet this route was considered first.

It is known from the personal experiences of TCA pilots that it will be necessary to be able to fly at any desired altitude up to at least 25,000 ft. in order to maintain the degree of regularity desired over the North Atlantic. This is because of icing and turbulent air conditions that are encountered during the winter months. The weather conditions, therefore, dictate the cruising altitude that must be attainable. The weather affects the choice of alternate airports, so it also dic-

Fig. 7—"Mock-up" of pilots' station in flight compartment.

tates the distance that the aeroplane must be capable of flying.

The cruising power is the most important criterion to be considered in the selection of the engine. Sufficient cruising power must be available to permit the fully loaded aeroplane to fly in an attitude of maximum Lift/Drag at the maximum desired altitude. This cruising power should, if possible, also be provided with the engine not developing more than 60 per cent of its rated power. The maintenance costs of the engine will increase rapidly as continuous power is drawn from the engines in excess of this percentage.

Consideration must also be given to the power available for take-off. Canadian airlines require more take-off power for the same aeroplane than most of the United States lines because its runways are snow covered for a large portion of the year. Fortunately it will generally be found that an engine that can provide sufficient cruise power for the North Atlantic operation will also be able to meet the desired take-off requirements.

Similarly the " one engine off " condition will not be a governing case with a four engined aeroplane and the severe cruising requirements desired.

It might be asked why such stringent cruising conditions are demanded when hundreds of aeroplanes are now flying the Atlantic each month with not nearly as much power available. The answer is merely that more power than is being used today is actually required for high altitudes in order to maintain the desired regularity with a scheduled commercial service during the winter months over the North Atlantic; and the North Atlantic is the more desirable direct route if it can be flown safely—which it can with a suitable selection of engine-aeroplane combination.

The selection of the engine follows somewhat the same procedure as that for the aeroplane in that the airline representatives visit the various engine manufacturers and talk to their technical personnel. They tell the manufacturer what aeroplane has been selected and what the flight conditions are that must be met. They then ask the engine manufacturer to suggest which of his engines he would recommend. All the technical data obtainable is then collected and a quantitative comparison made by the airline.

A weight analysis, engine performance analysis, range analysis, ultimate performance analysis and an economic analysis are first made.

This quantitative comparison of the engines may or may not in itself be sufficient to permit the selection of the engine. Certain very important considerations cannot be evaluated quantitatively. However, the quantitative analysis will usually weed out all but two or three engines.

A qualitative comparison is then made of the conditions surrounding the surviving engines being considered.

The most important item in such a comparison is the degree of responsibility assumed by the engine manufacturer for the design and subsequent operation of the entire power plant. By power plant is meant the engine and all systems and accessories related to its operation; roughly it includes everything forward of the firewall and a few items behind it.

British practice for many years has been for the engine manufacturer to assume the responsibility for the satisfactory operation of the entire power plant. In fact they will not sell an engine unless they have the controlling say in the design of its installation. They naturally co-operate with the aeroplane manufacturer to assure that the engine is located on the aeroplane exactly where the aeroplane manufacturer wishes and that the shape of the cowling is acceptable to the latter.

The British engine manufacturers design the complete power plant as a unit and subject every one of the many systems to the same rigid tests formerly applied only to the engine. Until recently, however, the engine was still designed by itself and the power plant designed around it. This policy is changing rapidly and the engine is now being designed to suit the power plant.

The aeroplane manufacturers in the United States on the other hand have maintained that it is their prerogative to design the installation of the power plant in their aeroplanes.

The successful functioning of any engine is so dependent upon the performance of its accessories and allied services that the development of the engine cannot be divorced from the development of the other items. The United States engine manufacturer would have had it so, like their British brothers, but they were not permitted to assume such responsibilities by the aeroplane manufacturers.

It is difficult to understand the thinking of the United States aeroplane manufacturer in the past. Although it was to their own advantage to have a trouble-free power plant they continue to struggle along by trying to do the job themselves. At the same time the airlines were frequently very much inconvenienced by the divided responsibility whenever trouble arose with the power plant.

The blame for such a situation is probably evenly divided between everyone. The United States airlines could have incorporated in their specification that, as the customer, they demanded that the design of the entire power plant be developed by the engine manufacturer; but they did not. The engine manufacturers before the war could have taken a chance and developed a complete power plant and offered it to the airlines; but they did not. The aeroplane manufacturers could have recognized the fact that many of the complaints to them were due to the inadequacies in the initial design of the power plant components and that no one should be in a better position to know what was wanted to run the engine correctly than its own manufacturer.

We believe, and hope, that it will not be long before the United States engine manufacturers adopt the method used in England and delegate the operation of the entire power plant to the position of greatest importance, and then design everything in a co-ordinated manner towards that end.

Considerable improvement must be made in the regularity of airline services before they can attain their rightful place in the general field of transportation. Delays and cancellations because of weather and mechanical troubles must and can be greatly reduced. The aeroplane designer can contribute to the former by first providing an aeroplane with good stability and control characteristics at low speeds, by providing sufficient power and climbing ability to enable the aeroplane to select any altitude desired to clear adverse weather, by providing accommodation for the latest radio equipment for instrument flying and landings, by providing adequate protection against icing of the propellers, engines and aircraft surfaces and by giving sufficient attention to the maintenance features that will permit rapid unit interchangeability. In his paper on the principles of airline operation, Mr. J. T. Bain covers the entire subject of regularity, unit replacement and related subjects much more fully than can be done here. It is sufficient to say that the airline must endeavour to work out alterations to the existing design with the aeroplane manufacturer to obtain the maximum amount of productive work from the aeroplane. In this respect it is essential that the minimum possible time be lost searching for the cause of troubles that are encountered. It must be possible to quickly isolate and replace defective units, or groups of units, so that the aeroplane may resume service without delay and the trouble subsequently located on the units replaced.

Features required to attain the desired degree of

Features Reviewed After Selection of Aeroplane But During Preparation of Specification

General

As previously stated, certain features in the design of the aeroplane can be readily altered to suit each customer. Such features include the interior arrangement, equipment and decorations, the radio installation, the instrument layout, the accessories used in the various systems, the heating and ventilating system, and so forth. It may not always be possible for the alteration to be made by the aeroplane manufacturer because it might interfere too much with his production line. The alterations can be made, however, even if they are made by the airline after taking delivery of the aeroplane.

Therefore, these features are not given too much consideration until the actual aeroplane has been selected on the basis of its suitability in other respects.

Regularity

The most important feature to be studied, after the selection of the aeroplane, is ways and means of obtaining the optimum in regularity.

By regularity is meant the ability to maintain continuity in the operation, as scheduled, regardless of adverse weather or causes inherent to the aeroplane. The ability to maintain regularity will automatically ensure the maximum utility of the aeroplane; utility being the ratio of productive hours of work from the aeroplane to the total number of hours in any period.

Fig. 8—"Mock-up" of navigator's station in flight compartment.

Fig. 9—"Mock-up" of radio operator's station in flight compartment.

regularity will in many cases increase the empty weight of the aeroplane and so reduce its pay load. In many cases the facilities can be obtained without sacrifice in payload if originally designed into the aeroplane. In any event, the improved regularity will increase the utility of the aeroplane sufficiently to more than compensate for any reduction in pay load.

COMFORT

Provisions for the comfort of both passengers and crew is of considerable importance in an airline aeroplane.

The public may be willing to sacrifice comfort to a certain extent in order to gain some other advantage, such as speed by air travel, but it is not long before there is a clamour to regain the previous degree of comfort to which they were accustomed. In general, any service to the public cannot regress in its provisions for comfort but must achieve its new objective while still providing at least the existing degree of comfort.

With increased distances being flown and increased responsibilities as a result of a larger size of aeroplane, the maximum possible comfort must be provided for the flight crew, in order that fatigue will be a minimum.

In the matter of comfort, a compromise must again be made between adding facilities at the expense of pay load or accepting certain limitations in order to be able to carry sufficient passengers and cargo to make the operations economical.

Comfort is a requisite that is unfortunately intangible in many respects. The following are but a few of the items that must be considered in relation to providing comfort for passengers and crew:

Chair design and chair spacing.
Noise.
Vibration.
Temperature and temperature distribution.
Ventilation and air circulation.
Illumination; reading and writing facilities.
Visibility and window treatment.
Cabin air pressure and rate of change of this pressure.
Vertical accelerations.
Odours.
Colour psychology and harmony of line of interior decorations.
Spaciousness, both actually and by optical illusion.
Wash-room and toilet facilities.
Meal service, including provisions for infants, diabetics, etc.
Luggage, and outer clothing stowage.
Radio programmes and news broadcasts.
Cabin attendant service.

Passengers want to arrive at their destination completely refreshed, resulting from having had a feeling of safety and luxury throughout the trip and also with the feeling that the airline has been catering specifically to the comfort of each individual. The above items are studied with this objective in view.

EQUIPMENT

Equipment lists are next prepared for inclusion in the specification.

If time permits the object is to use as much equipment as possible from the airline's running specification of the ideal aeroplane.

If time is not available to engineer the changes that would be involved by adopting the above policy, the opposite policy is adopted. That is, every effort is made to retain the equipment originally chosen by the aeroplane manufacturer unless there is good reason to change it.

One reason for changing the original equipment may be its known inadequacies for cold weather operations. A more common reason, however, is its unsuitability to permit the adaption of the airline's principles of operations. Occasionally it is because the airline's past experience indicates that it might not obtain the desired service from the particular equipment manufacturer. Unless the airline obtains the complete cooperation of the manufacturer to facilitate its maintenance and overhaul of a piece of equipment, it will not do business with that manufacturer.

As a matter of basic policy, the entire success of any airline is built upon the complete co-operation of everyone connected with it. It has no time, therefore, for individuals or manufacturers who wish to withhold information related to the operation, maintenance and overhaul of equipment.

The installation of equipment is a problem that is of vital interest to the airline. It is so important to the operation, servicing and maintenance of the aeroplane that most airlines build their own mock-ups to arrange instruments, electrical panels, radio equipment, cabin interior, dressing rooms and toilets, cabin attendant's station and galley. Some airlines would undoubtedly like to include the installation of hydraulic equipment in their mock-ups to better provide for their own servicing and maintenance requirements but this is usually left to the manufacturer.

A photograph of the flight compartment mock-up of T.C.A.'s new aeroplane is shown in Figs. 6 to 9. This mock-up, although made of wood, is exactly to scale. The equipment used in the mock-up is either wooden models or actual samples.

GROUND FACILITIES

One may have gathered from the discussion so far that the engineering selection of an airline aeroplane is not a small job. An even bigger job is required in the development of plant and ground equipment if the aeroplane selected is radically different from the aeroplanes currently in service. It has been estimated that over one hundred thousand man-hours of engineering alone will be required to provide the servicing, overhaul shop, and personnel training facilities that will be required to accompany the adoption of a medium sized four-engined aeroplane in addition to the small two-engined aeroplanes now in service.

SERVICE EQUIPMENT

Servicing equipment includes every piece of apparatus used in connection with the operation of the aeroplane.

The basic principle involved in the design of service equipment is to enable every job that must be done on the aeroplane to be accomplished as quickly as possible by a reasonable number of persons.

Although the entire development of service equipment is outside the scope of this paper, the problems involved must be borne in mind so that the aeroplane itself will incorporate as many features as practical to assist in its servicing.

SHOP EQUIPMENT

Shop equipment refers to tools, jigs, fixtures, and test equipment used in the overhaul of components removed from the aeroplane.

The features of the aeroplane that would assist in simplifying its overhaul are, for the most part, beyond the control of the airline as they are basic features incorporated in the initial design of the aeroplane's components. All that an airline can usually do is to bring to the attention of the manufacturers any bad features in their designs from overhaul standpoint so that these mistakes will not be repeated in subsequent designs.

PERSONNEL TRAINING

The problem of training personnel to service and overhaul the aeroplane selected is in general outside the scope of airline engineering other than any assistance it might give to the Education Department. Such assistance is usually in the form of charts, isometric drawings and technical explanation of the operation of different instruments and accessories.

CONCLUSIONS

Although the airline must accomplish a tremendous job in the preparation of its Detailed Specification, particularly in view of the fact that its basic job of running a transportation service must still go on, " it more than pays dividends ".

We are confident that the manufacturers would be first to acknowledge the assistance that they have obtained from the airlines.

In conclusion we would like to pay tribute to the leading airlines in the United States. They have been models of efficiency and have attracted to themselves many men of outstanding ability. The manner in which the United States Army Transport Command has operated a world wide service of tremendous size is a direct result of the experience gained in its commercial airline operations. The leading place held by the United States manufacturers of commercial air transports is also due in no small degree to the exacting demands of their airlines.

We in Canada are fortunate in that, because of our associations with both England and the United States, we feel no hesitancy in adopting ideas and equipment from either country whichever we feel is the better in a particular field. We also hope to contribute our share towards ensuring that air transportation develops on a sound business-like basis.

DISCUSSION

J. A. T. Butler, M.E.I.C.[1]

Mr. Dyment's paper dealing with the engineering problems involved in the selection of aeroplanes suitable for the operations of a particular airline, and Mr. Bain's remarks in connection with the maintenance and operation of these aeroplanes in service have been most interesting and instructive to one like myself who is concerned with the design and development of such aeroplanes.

Many aeroplane and equipment manufacturers today, especially in Canada, are out of touch with the latest developments in airline engineering as they have been absorbed almost exclusively for some time in war contracts. It will be of the greatest benefit to them to have, from the airlines, clear cut and detailed specifications as to what is required. In the final analysis, it is the air travelling public and the users of air freight that have to be satisfied. The airline operator, being in constant touch with the public, is the agency best qualified to interpret the public's requirements and desires. I know that the aeroplane manufacturers will welcome gladly any help the airlines can give them. Mr. Dyment has made abundantly clear the close teamwork required between the various groups concerned. As he has pointed out, the design of an aeroplane is one tremendous compromise and only the closest co-operation can result in the production of an aeroplane suitable for doing the job required of it.

It is evident that Mr. Dyment has prepared his remarks with a definite size of aeroplane in mind, namely, one such as the DC-4 with a gross weight of 50,000 lb. or more. I would be most interested in knowing what other sizes of aeroplane TCA has in

[1]Chief Engineer, Fairchild Aircraft Limited, Longueuil Que.

mind for post-war use. That is, what size it considers most suitable for each of the various types of service it proposes to provide, as well as any special features considered desirable due to Canadian operating conditions. On the mainline routes, operating conditions more nearly approach those in the United States, but on the smaller feeder-line routes the conditions vary considerably. It seems to me that Canadian manufacturers can prove most helpful to the Canadian airlines, at least in the immediate future, by concentrating on those problems peculiar to Canada. These will appear to confine their activities to the smaller feederline and bush cargo type of aeroplane with, perhaps, the alteration or conversion of larger planes of foreign design.

Mr. Dyment also mentioned the desirability of the engine manufacturer being responsible for the design of the power plant installation. I agree that it is desirable that the engine manufacturer take an active interest in the design and that his criticisms should be sought. However, there are no aircraft engine manufacturers in Canada and we are entirely dependent on foreign supply. In view of the extreme weather conditions encountered in this country it might be desirable, therefore, to continue to make the power plant installation design the responsibility of either the aeroplane manufacturer or the airline, although, with the increasing expansion of air services over the world and the consequent increase in world wide experience this argument will probably become less important in the future.

R. D. Speas[2]

Mr. Dyment mentioned the survey of airport requirements which are prevalent in the introduction of new aircraft. Trans-Canada Airlines and American Airlines are planning future operation of the same basic aeroplane for the future, namely, the DC-4. It is encouraging to learn through conversations of last night and to-day that we are both thinking in the same terms with regard to runway length requirements of the aircraft. All standardization of technical thinking in these matters is, of course, extremely helpful in discussing our problems with the various meteorologists and federal authorities.

In considering the matter of aeroplane speeds which Mr. Dyment discussed, we have found that speed is not necessarily synonymous with high cost of operation. Many cost factors are lower at high speeds than they are at low speeds. Aircraft maintenance, flight crews, passenger service, and other factors are all favourably affected by high speed operation. A recent survey indicated that the most economically desirable cruising power for Douglas DC-3 on comparatively short range operation is 650 h.p.—50 h.p. higher than our engine limit will allow.

Warren T. Dickinson[3]

Mr. Dickinson wished to point out that a manufacturer must have a customer before he can go ahead with a design, on account of the high cost of building large aircraft due to the present complexity of the machine.

With regards to Mr. Dyment's reference to the desirability of the engine manufacturer being responsible for the design of the power plant installation, Mr. Dickinson remarked that his company felt that the responsibility for the whole aeroplane and all its parts must rest with the seller, namely the aeroplane manufacturer, and accordingly they did not like to delegate this responsibility.

[2]Assistant to the Vice-President in charge of Engineering, American Airlines Inc., New York.

[3]Assistant to the Chief Engineer, Douglas Aircraft Company, Inc., Santa Monica, California.

J. J. Green, M.E.I.C.[4]

Mr. Dyment is to be congratulated on the fine paper which he has presented. To my knowledge, this is the first time that such a paper, dealing with the co-operation between airline operator and aircraft manufacturer, has appeared and I feel sure that it will receive the wide attention which it merits.

Mr. Dyment has spoken of the demands made by the airline operator on the manufacturer, but he might have stressed the limitations placed on the designer by the fact that the aircraft has to meet stringent airworthiness requirements predicated mainly, if not wholly, on safety standards. These limitations cannot be minimized in importance.

Despite the high engineering costs in developing new aircraft, the aeroplane, in comparison with other vehicles of transport, has a much greater ratio of maintenance cost to initial cost. Whilst in the past, ease of maintenance has been considered desirable, it is only now that its paramount importance in saving cost and time is being recognized and is receiving the close attention which it deserves.

The author has referred to the immediate post-war availability of military transport aircraft for civilian use but points out that these are merely " stop-gaps ". Since recent designs will become obsolete due to progress in aeronautical research and development, perhaps it is an advantage that we have these " stop-gaps ", not only because we can save something from the money invested in them but also to ensure that post-war designs may have an opportunity of incorporating some of the many important advances which have resulted from the increased tempo of research due to the war.

Mr. Dyment has referred to the potential traffic survey as the weakest link in the chain of facts dictating the design of aircraft. I have some comfort for him here. The Air Transport Board, which I am representing, will, I believe, be responsible for such surveys in Canada. While this task is, as he pointed out, a very difficult one, I can assure him that it will be receiving very close attention.

The good work which has been done by the airlines in contributing to the development of air transport aircraft is reflected in the appearance of a new engineering philosophy which has been given the title "Aero Economics ". This is a study of the economic problems involved in aircraft design and operation, leading to the most economic solution of the inter-related aero-dynamic and operational problems. The Lockheed Aircraft Corporation is pioneering in this new study to meet airlines requirements, and this approach to the problems should be most beneficial.

The Author

In reply to Mr. Butler's query concerning the fact that we have mentioned only one type of aeroplane in this paper, I would like to say that we expect very

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shortly to commence investigation of the replacement aeroplane for our existing twin-engined equipment. This will be a smaller craft than the four-engined machine discussed in the paper as it will provide the local services that will be required in addition to the express services to be provided by the four-engined aeroplane.

Mr. T. W. Siers, General Superintendent of Maintenance, Canadian Pacific Airlines, expressed at the meeting his hope that the manufacturers do not forget that the airlines have contributed much to the development of the aeroplanes in the past. In this connection, it might be appropriate to mention that Mr. Siers is the father of oil dilution, insofar as its actual use is concerned. Canadian Pacific Airlines' planes have used oil dilution successfully for the past four or five years, and have obtained cold starts in temperatures down to —50 deg. F. Mr. Siers worked closely in co-operation with Wright Field during the initial development of oil dilution and can readily demonstrate that, if the instructions as developed by him are followed, there is no reason to encounter trouble with the use of oil dilution on both air-cooled and liquid-cooled engines.

I appreciate very much the comments of Mr. Speas of American Airlines. I would just like to say thanks on behalf of our Canadian airline for the fine co-operation and help we have obtained from his company in the past, and say that he can be assured that the utmost co-operative spirit will always prevail between our Canadian and sister American organizations.

I would also like to thank Mr. Dickinson of the Douglas Aircraft Company for his remarks. In relation to his assurance that the Douglas company assumes the responsibility for the entire power plant, we will bear it in mind in the future when we commence to use his aeroplanes.

In relation to the limitations placed upon the designer by Airworthiness Requirements, mentioned by Dr. Green, I would like to say that the leading airlines are unanimous in their desire to see Airworthiness Requirements made as exacting as possible, to improve the safety of air travel. There are very few changes that the airlines wish, in fact I can think of none, that would not increase the safety of an operation rather than decrease it. If one can simplify a thing, reduce the human element involved in its operation, and provide greater comfort in all its aspects for the flight crew, one is bound to improve safety, other things being equal.

In relation to the economics of airline operations, we feel that we are very fortunate that the Government has initiated the Air Transport Board. We are confident that we will receive valuable assistance from this Board as soon as its staff has analyzed the statistical data it is now collecting. In this regard, it might be of interest to engineers to know that the responsibilities of T.C.A. Engineering Department also include economic research. The nature of the engineering organization in T.C.A. is such that it is in an excellent position to know the requirements of all other departments in the company.

CANADIAN ENGINEERS IN GERMANY

This is the "Gales" bridge, a thousand foot floating Bailey over the river Eems near Leer. The Eems is a tidal river which had to be crossed by the Canadians before Leer could be taken. *(Canadian Army Overseas Photo)*

FUTURE ASPECTS OF RADIO AND COMMUNICATION IN AIR TRANSPORTATION

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Paper delivered at the Fifty-Ninth Annual General and Professional Meeting of The Engineering Institute of Canada, in Winnipeg, Man., on February 8th, 1945.

Introduction

Some conception of the phenomenal progress in air transportation in a little more than two decades can be gained by dividing the 1920-1944 era into two periods. During the first part, helmeted and goggled air mail pilots, with little else than their wits to help them, forced a skeptical public to realize the value and potentialities of air speed. In later years, the commercial air transportation picture took on form and substance. Steady, painstaking improvements were made in planes, pilots, policies and flying aids. The radio aids to air navigation used during the "Flying Forties" were developed prior to 1935. Reliance is placed on these electronic aids to such a degree that without it modern air transportation could not function efficiently.

We are now looking to the "Age of Flight"—the post-war period, in which radio and electronics will play a phenomenal part because war development has provided the stimulus for invention to so great a degree that years of war are equivalent to as many decades of peacetime development. This was true of the aeroplane in the last war and is equally true of radio and radar during the present war.

In the coming post-war period we must realize that the time is past when the aeroplane user was satisfied with arrivals, *someplace* at *sometime*. He may be grateful now, but he is not satisfied. Just as users of other modes of transportation grow more exacting as the industry advances, so the aeroplane passenger and shipper become less and less tolerant of disappointments and delays. Growth of air transportation requires that facilities and services used by it must also advance. Here in no small degree, radio, wired communications and radar must play a very great part. Indeed, it can be said that the safe and efficient operation of air routes has come to depend largely upon the application of radio technique in all its many forms and modifications to navigation and communication, and in future will do so to a much greater extent.

The reader will appreciate that a complete treatment of the subject is impossible at the present time, due to security reasons, as many devices which are still considered military secrets will in the post-war days have a definite commercial application. Within the scope of the above limits this paper is presented.

Two-Way Communication

General

The function of two-way communication is to establish communications between aircraft in flight and respective ground stations in order to transmit instantaneously between aircraft and ground all essential information that may be of value in conducting a flight in the safest and most efficient manner. As the speed of the aircraft increases, the speed of communication must increase, and radio is the only means by which this can be satisfactorily accomplished. In airline operation, because of the necessity of having complete flight control to obtain maximum safety, satisfactory instantaneous communication is demanded and its importance will assume major proportions in the future, particularly in the post-war period when the volume of airways traffic will be increased. In international aviation, communications between air and ground sometimes involve a major difficulty, particularly when there is a difference in language. It has been suggested that this can be completely overcome by the adoption of a common language or phonetic code, but such a solution is not likely to prove practical under all circumstances. We in Canada are fortunate in having a common language with the United States and British Commonwealth countries but there still remains many problems, and for this reason the only solution seen at present in international aviation is to make use of wireless telegraphy and international code in cases where such differences exist. Two-way communication can be divided into two categories (a) Short Range Communication, (b) Long Range Communication.

Short Range Communication

In short range communication, there will be a complete change in trend in the future. Before the war we used medium frequencies in the region of 5000 kc. for this communication and found it was not entirely satisfactory due to skip conditions, atmospheric static and violent fading under certain conditions. In the post-war

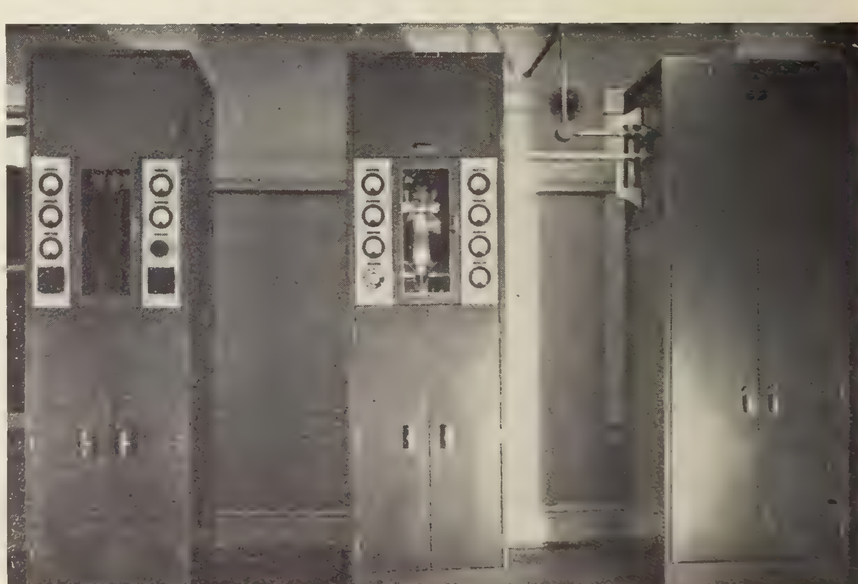

Fig. 1—Northern Electric Model 14C, 10 channel, crystal controlled transmitter used at majority of Trans-Canada Air Lines ground stations.

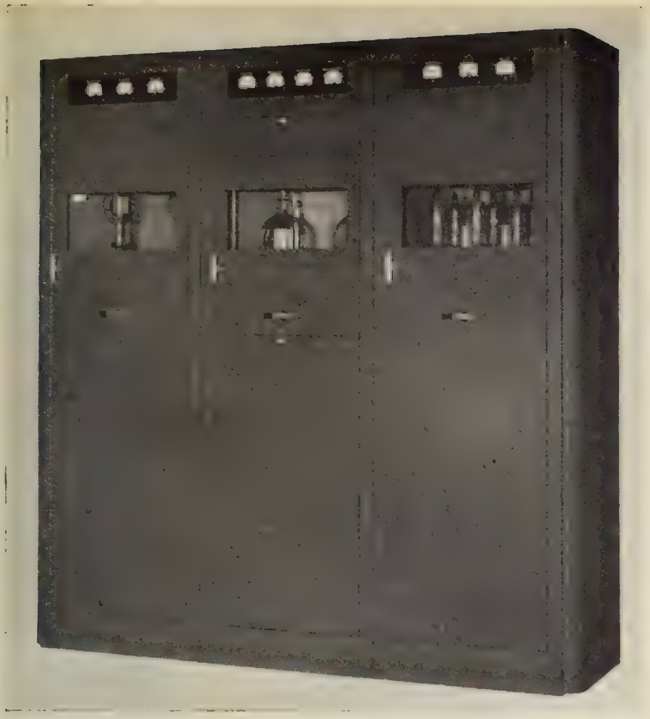

Fig. 2—Collins high powered, 10 channel, crystal controlled ground station transmitter used at several Trans-Canada Air Line Maritime stations.

days there seems little question but what there will be a definite adoption of very high frequency communication using the frequencies in the band between 118 and 132 megs. which follow the line-of-sight theory. The advantages derived from use of the VHF spectrum for radio communications are as follows:

1. Elimination of atmospheric static.
2. Practically complete elimination of precipitation static.
3. 100 per cent communication under all conditions if due consideration is given to the number and geographical location of very high frequency transmitter sites.
4. Elimination of interference from other stations working on the same very high frequency—providing such other stations are beyond the normal line-of-sight horizon.
5. Reduction of weight of aircraft radio equipment —compared to that now required for medium frequency equipment.
6. Cost of very-high equipment is substantially lower than its equivalent for use in the medium frequency spectrum.

Routes over land and populated areas lend themselves to the adoption of this system of very high frequency radio communication and is the only practical answer to efficient two-way communication between aircraft and ground stations. As a result of this war, VHF technique is now definitely past the experimental stage and it is interesting to know that over 30,000 VHF communication units have been installed for military services and have resulted in perfect communication between aircraft and ground stations. Generally, in countries where a common language can be used, radio-telephone is preferred but short range communications in certain areas in Europe will necessitate the use of wireless telegraphy and international code for the reason referred to previously.

The technical requirements of the transmitter-receiver to serve short range communications has definitely crystallized from the airline requirements for the post-war period. These will briefly be reviewed.

As stated, this equipment provides the following service:

1. Two-way communication between pilot and ground or from aircraft-to-aircraft when languages permit.
2. Static-free communication up to a range of about 75 to 100 miles at 3000 to 9000 ft., respectively. (Line-of-sight theory.)
3. Aid to final approach for an aircraft through the media of talking the aircraft down.

The following engineering factors on airborne equipment therefore become important from operational considerations:

(a) *The Choice of frequency channels*

To meet the need of airlines, it has been determined that a 10 frequency transmitter-receiver is necessary using as a basis the fact that in a 30-mile diameter around a large city there may be four major and two minor airline terminal airports. This would consist of the following channels:

Channel – 1. Principal Company airway frequency.
Channel – 2. Alternate Company airway frequency, to avoid interference.
Channel – 3. Principal airport control frequency.
Channel – 4. Alternate airport control frequency.
Channel – 5. Principal "Talk Down" ground instruction frequency.
Channel – 6. Surface traffic control frequency.
Channel – 7. Spare frequencies to provide for possible future contingencies.
Channel – 8. Spare frequencies to provide for possible future contingencies.
Channel – 9. Spare frequencies to provide for possible future contingencies.
Channel –10. Spare frequencies to provide for possible future contingencies.

(b) *Polarization*

Vertical polarization is desirable because:

1. The VHF antenna should have omni-directional characteristics in azimuth.
2. A vertical antenna is more conveniently constructed on an aircraft and is less susceptible to ice and wind drag.

(c) *Modulation*

Amplitude modulation is desired because of the disadvantages of "capture effect" characteristics of frequency modulation.

(d) *Channel Separation*

It is desired to have 180 or 200 kc. channel separation in order to make possible a number of pre-set frequencies in one channel if it is found to be necessary.

(e) *Frequency*

It should cover a range of 108 to 132 megacycles.

(f) *Weight*

The weight should be kept as low as possible not to exceed 50 lbs.; this includes power supply.

(g) *Power*

12 or 24 volt D.C. as this will be the prevailing power source for the next five years for standard transport aircraft.

(h) *Power Output*

5 to 10 watt R.F. power has proved sufficient for aircraft equipment.

(i) *Guard Frequencies*

It is desirable to have a standardized frequency known as a guard frequency on which all aircraft in an area will be standing by.

(j) *Control*

Remote electrical control.

The above are the operational requirements of VHF equipment and it might be stated that, with the above, VHF is bound to materially affect future communication and give us a system which far surpasses anything we had prior to the war.

LONG RANGE COMMUNICATION

On certain routes over land and particularly over large bodies of water, it is physically impossible to use VHF communication because the distances involved exceed the line-of-sight value. H.F. communication equipment must necessarily be used in this particular field. This term covers equipment in the frequency range of 3 to 30 megs. Equipment for this portion of the frequency spectrum was developed before the war and, in the post-war days, advantages will be realized through weight saving, construction and experience gained during the war. H.F. equipment provides the following service for airline operation.

1. Long range telegraphic and telephonic communication.
2. Short range telegraphic and telephonic communication in event of failure of VHF communication set.
3. Long range aids to navigation for aircraft in which the H.F. receiver is used as a direction finder or the H.F. transmitter is used in conjunction with H.F. ground station direction finders, for the purpose of giving radio bearings to the aircraft in flight.

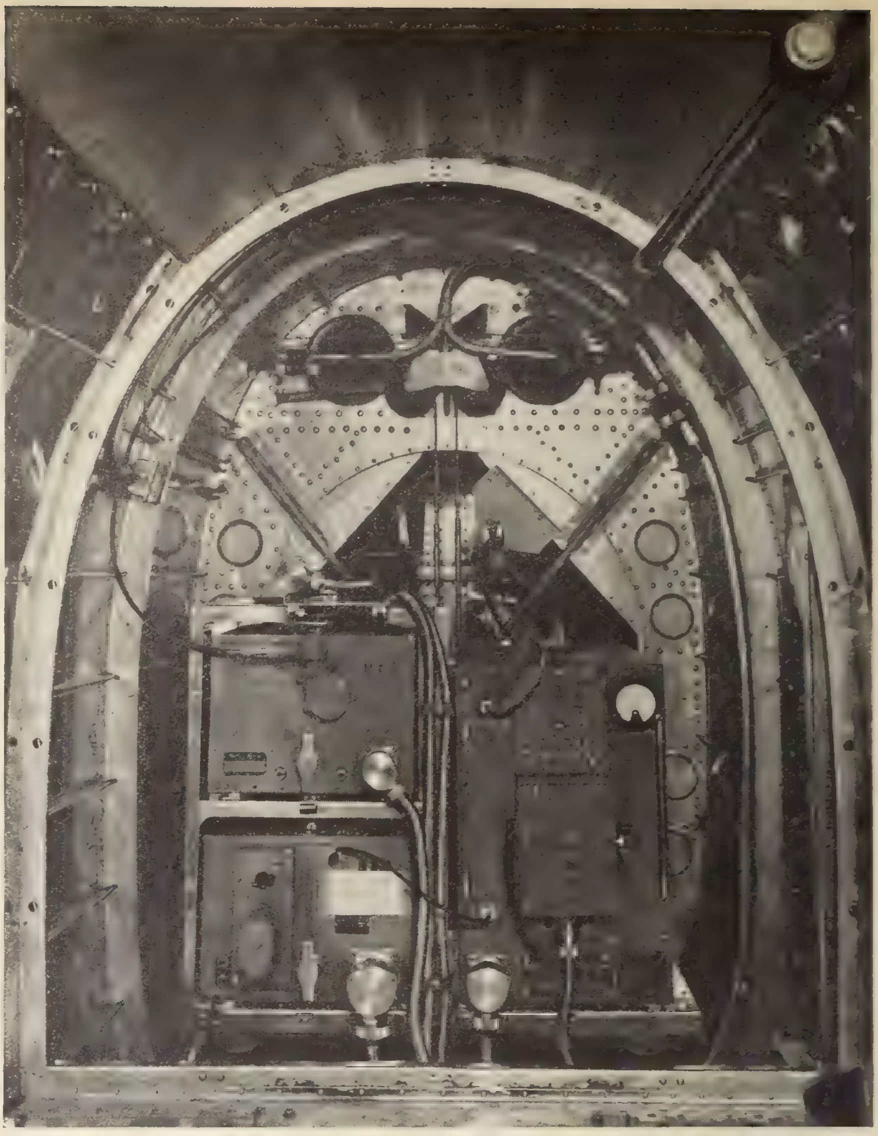

Fig. 3—Typical T.C.A. installation in tail of Lockheed aircraft.

The engineering specifications and requirements which are well known and are of basic technique do not need to be described further. However, it is desired to state that long range operation will necessitate at least a minimum of two receivers on these frequencies. One of them preferably will be a pre-set crystal-controlled receiver working in conjunction with a crystal-controlled transmitter and the other one a receiver which is tunable. In addition to this, most airline operators feel it is also desirable to have two receivers which cover both H.F. and M.F. spectrum (300 kc. to 3000 kc.) for the purpose of direction finding.

(a) *Modulation*

Amplitude modulation is desired the same as in the VHF equipment and for the same reason.

(b) *Channel Separation*

For telegraphic work 5 kc. separation is desirable, and for radio telephone work 10 kc. separation is desirable and required.

(c) *Frequencies*

One transmitter should work in the band of 300 kc. to 12 megs. with a variable output frequency that can be pre-set as may be required to communicate with certain stations. Whereas the second unit should be a communication transmitter capable of working between 2.6 and 12 megs. and should be crystal-controlled for pre-set frequencies on which tuning is unnecessary.

(d) *Receivers*

Two receivers will be required to cover band of 300 to 600 kc. These will be used for navigation and direction finding purposes and will make running "fixes" on radio stations possible. One tunable overall receiver is required to cover that portion of the spectrum between 100 and 15000 kc. and one fixed pre-set crystal receiver working in conjunction with a pre-set crystal-controlled transmitter, between 2.6 and 12 megs.

(e) *Weight*

The weight should not exceed 80 lb. per unit for individual transmitters, nor 40 lb. for individual receivers, and 80 lb. per unit for the pre-set crystal-controlled H.F. receiver and transmitter.

(f) *Power*

Should be 12 or 24 volt D.C. for same reasons as outlined in VHF.

Fig. 4—Ground radio station communicating operating positions.

(g) *Power Output*

Should be minimum of 50 watts and preferably as much more as possible giving due consideration to weight.

(h) *Receiver Sensitivity*

2 microvolts maximumC.W.
5 microvolts maximum 30% modulated for phone.

Based on 50 milliwatts output with signal to noise ratio of 10 db.

(i) *Stability*

± 0.02%.

(j) *Types of Communication*

Both the transmitter and receiver should be adapted to radiotelephone and radiotelegraph communication.

Radio Aids to Navigation

GENERAL

The war has made tremendous strides in the field of radio aids to navigation, much of which will not find its practical application to air transportation until some time after the end of hostilities due to present necessity for security.

Before the war the most common method of radio navigation in Canada and the United States was the standard four course range station operating in the frequency band of 200 to 400 kc. These ranges are normally spaced about 100 miles apart and their on-course legs are usually aligned so as to coincide with established airways. The field of radio aids to navigation can here again be divided into (1) short range aids to navigation used mostly in conjunction with land routes, and (2) long range aids to navigation generally used on routes over water or sparsely settled country.

SHORT RANGE AIDS

The present low frequency range offered the simplest and best known method of flying a fixed flight path before the war, but it has several disadvantages from the operational standpoint. The main disadvantages are that it operates on frequencies where atmospheric static is commonly present sometimes to the extent that the signals are unusable. This happens in storm areas and under conditions of instrument flight and also under circumstances and at times when it is most important to have available all the possible aids. Static is also a source of mental fatigue to the flight personnel, which is undesirable. In addition, it has the undesirable feature that there is no means of quickly determining in which of four possible sectors of a range one is flying without a rather complicated process known as "orientation".

The essential radio range requirements for airline operation can be listed as follows:

1. Static free reception.
2. Preferably visual indication instead of oral, as at present.
3. Aural station and sector identification.
4. An indication of distance from the range station. This should be continuous.

The VHF spectrum gives us a solution to the first problem of atmospheric static and therefore it is planned to operate future ranges in the frequency spectrum of 112 to 118 megacycles. At this frequency, there is little atmospheric static and normal reception is by direct path only which is limited by optical horizon. Considerable experimentation has been carried out by the United States, Canada and others on ranges in this frequency band with the result that it has been decided that, for the immediate future, possibly the next three years, plans for installation will be concentrated on the two-course, visual indication VHF range with aural station and sector identification. In the post-war period, it is felt that these ranges will be modified to furnish omni-directional characteristics if found desirable and to give continuous distance indication.

The two-course VHF range, while offering a satisfactory solution to flying a straight line between two points, is not satisfactory for large cities where multiple airways intersect. Here it would be possible to install a number of two-course ranges, but a more satisfactory solution would be omni-directional VHF radio ranges, which would give azimuth indication over 360 deg., resulting in the fact that the pilot of an aircraft could know his position with reference to the range station instantaneously regardless of the aircraft's position in relation to the station. This would be of great value to the private flyer who generally does not fly an airway and would still offer the airline pilot the advantages of a pre-determined fixed flight path. This, with continuous distance indication, would offer every desired feature needed by an airline operator.

AIRBORNE EQUIPMENT

The aircraft equipment necessary to fly a two-course or omni-directional VHF range is only a receiver having preferably a number of pre-set range frequencies, any of which can be chosen by means of a push-button or selector switch. Twenty-five pre-set frequencies should be sufficient along any domestic airway.

Other engineering factors to consider are:

(a) *Frequency Coverage*

The frequency covered by this receiver should include the 108-112 megacycle localizer band and the 112-118 megacycle range band. As the range and localizer features will never be used simultaneously, it is the consensus of airline opinion that both bands should be covered by one receiver.

(b) *Polarization*

Vertical polarization is desirable for the same reasons outlined under (b) of the VHF Transmitter-Receiver.

(c) *Modulation*

Amplitude modulation is desired for the same reasons outlined under (c) of VHF Transmitter-Receiver.

(d) *Channel Separation*

180 to 200 kc. channel separation is desirable.

(e) *Weight*

The weight should be kept as low as possible not to exceed 35 lb. including power supply.

(f) *Power Supply*

Universal 12 or 24 volt.

(g) *Control*

Remote electrical control for selection of any frequency in a time not to exceed two seconds.

(h) *Sensitivity*

Output: 50 milliwatts with a signal-to-noise ratio of 20 db. or better.

Input: 5 microvolts maximum with 30 per cent modulation.

In the concluding remarks on short range aids to navigation it might be stated that the choice of sites is extremely critical in the prevention of serious multiple paths on any range operating in the region of 100 to 300 megacycles, when the flight path is made up of two or more field patterns on which the amplitude of the signal determines the flight path. This is true of any amplitude comparison device and the only solution in the future is a range that depends upon the timing of a signal from the source to overcome this inherent difficulty. This does not exclude the use of the present VHF ranges but extreme care and considerable study and field trials should be made before the establishment of a series of VHF ranges are made over a designated airway.

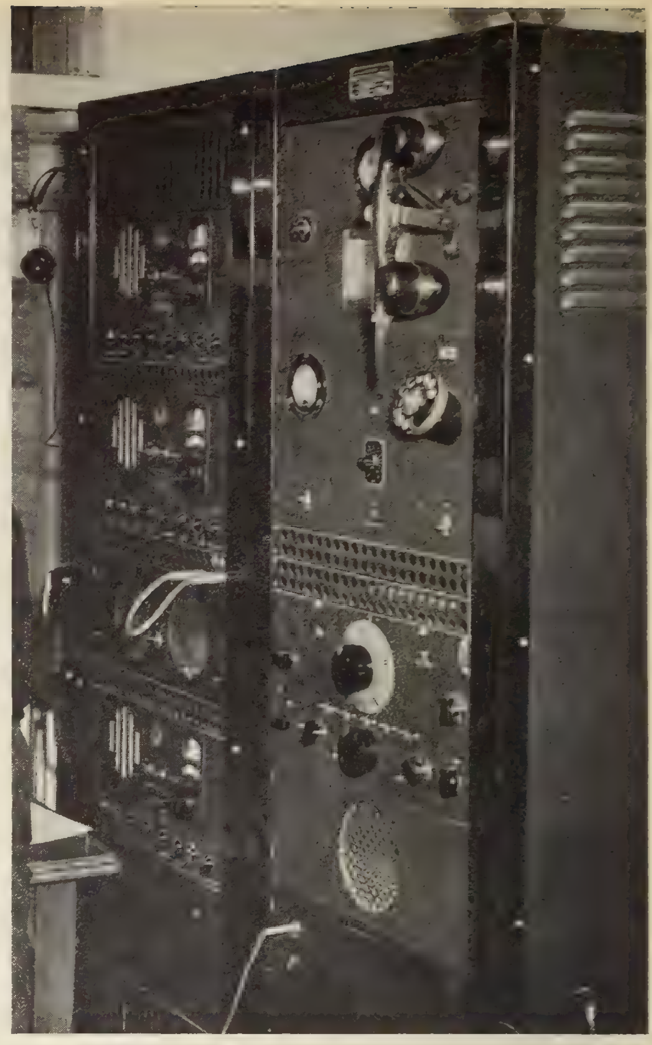

Fig. 5—Typical equipment used in Department of Transport radio range stations. The left-hand rack holds tunable receiving equipment. The right-hand rack contains radio range remote control equipment.

LONG RANGE AIDS

In the field of long range aids to navigation the picture is not so clear as to what will constitute the complete system, and certain applications and techniques which are now secret may decisively change the picture, and for that reason, as we know our requirement, these will be discussed together with known aids that will definitely still play an important part in long distance flight operation.

By long distance aids, we mean aids to those operational flights in excess of 3 hours' flying time or 600 miles over land or water which do not and could not follow a series of short range aids to their designated landing. At the present time, in flights over this distance or greater, celestial navigation is used to a great extent. Celestial navigation has a number of disadvantages, some of which are:

1. They require a navigator with specialized training.
2. In rough air, the accuracy leaves a lot to be desired.
3. In daytime the sun must be visible, and often in instrument weather this is not the case.
4. At night time the celestial bodies must be visible in order to take sextant readings.
5. In winter icing conditions the astrodome of an aircraft ices up to a point where it is difficult to take shots even if the celestial bodies are visible.
6. Continuous position indication is not possible.

In general, it is felt that radio navigation forms a far more desirable method of long range navigation, but celestial navigation will always be a desirable adjunct in event of failure or malfunctioning of the radio aids.

The specifications from an operational standpoint of desirable characteristics for long distance radio navigational aids are as follows:

(a) *Services Required*

The system must provide the most satisfactory possible navigational aid for aircraft engaged in transoceanic operation. It should also be capable of providing a service for aircraft over land in regions where other radio facilities are not provided.

(b) *Distance Coverage*

Position fixing over sea is required by day or night at distances up to 1500 miles from the furthest station in use, assuming there is an average atmospheric noise level. A coverage of 750 miles is required over land under similar conditions.

(c) *Accuracy*

The position fixing error should be less than 1.5 per cent of the distance from the furthest station in use, or an error of 10 miles, whichever is greater.

(d) *Navigating on Position Line*

It should be possible to navigate on any great circle track towards or away from any of the component stations of the system. For this form of navigation, the pilot should be provided with a visual indication that the aircraft is flying along the chosen track.

(e) *Band-Width*

The frequency band occupied by the system should be as narrow as practicable in order to facilitate and conserve the international allocation of frequencies.

It is obvious that to get the coverage required for long distance operational flight the system will have to operate on frequencies of the order of 100 to 6000 kc. for satisfactory propagation characteristics. There are numerous marine, range and broadcasting stations operating on these frequencies that are being used for aircraft radio direction finding at the present time. Stations on frequencies up to 1500 kc. and of over 15,000 watts power output are excellent for direction finding work from aircraft. The important factor is that stations on these frequencies should have as much power as possible to override atmospheric static conditions that usually prevail in bad weather, particularly during snow and thunderstorms.

Certainly on omni-directional high power range whose field pattern furnishes a number of equi-signal lines that constitute great circle positions would furnish a valuable navigation aid to long distance flights and would always furnish a valuable adjunct to newer systems in the future. In the post-war period it would be an important supplementary service to a primary service offered by newer devices.

One great advantage in using standard radio ranges and broadcast stations in this frequency range is that no additional aircraft equipment is necessary, other than the communication receiver already in the aircraft that covers the required frequency band.

Radio Direction Finding System

General

Ground station direction finding systems at the present time offer a supplementary radio aid to long distance flights which will continue to function in that manner after the war. Briefly this system involves the use of one or more ground direction finding stations and an aircraft transmitting station. Apparatus is available at each direction finding station by means of which, as a result of a steady transmission from an aircraft, sufficient information is obtained to make it possible to lay off on a map a position line which will pass through the ground D.F. station and also through the aircraft position. If position lines obtained by two or more ground D.F. stations are plotted, the intersection indicates the position of the aircraft. This "fix" information is then passed back to the aircraft by radio. In some cases, the pilot requires only "homing" bearings. For this purpose only one D.F. station is necessary and this is often of a simpler type, since the accuracy need not be as high as required for "fixes".

Direction finding, to be of maximum value to fast moving aircraft, must give instantaneous readings and this can be done only by automatic means. The war has done much to develop the automatic direction finder, particularly the cathode ray type which gives an automatic indication the moment a carrier is transmitted. These readings are instantaneously transmitted back to the aircraft in a minimum of time so that the "fix" from two or more D.F. can be plotted either in the air or ground and give the pilot a "fix" as soon as possible. This system has the disadvantage of requiring two or more people and an extremely high degree of team work not necessary with other systems.

Ground D.F. systems are susceptible to two main classes of errors. The errors within the first class are due to unsuitable polarization of the received wave. Errors are generally introduced if the polarization is such that the electrostatic component of the wave is not vertically polarized. Even if the polarization of the transmitted wave is correct, the polarization of the received wave may differ owing to the reflection from the ionosphere. This is known as "night effect" because, in the case of medium frequency direction finding, indirect reception is more prevalent at night.

The second type of error is generally classified as site errors. These are introduced by asymmetry of the terrain immediately surrounding the D.F. aerial system and obstructions, such as hill, large obstacles and oblique coast lines. All these have the effect of bending the path of the signal, the effect being greater the nearer the obstruction is to the D.F. station. Incidentally, what has been said about these errors in D.F. technique also applies to range station operating in the same frequency spectrum. They are kept at a minimum by specially designed aerials.

Instrument Landing and Approach Systems

General

As stated in the introduction of this paper, in the coming post-war period the people using air transportation will not be satisfied with probable arrivals someplace at sometime. Commercial air transportation must be maintained on a basis comparable to or even better than other modes of transportation. The only answer to this problem lies in the use of radio aids in instrument approaches to final landing, known as instrument blind landing. For those who are unfamiliar with the term, it is necessary to define the instrument blind landing and instrument approach systems.

Blind landing is taken to mean the safe landing of an aircraft during the worst possible weather conditions and visibility. The term instrument approach system is defined as the method whereby a let-down can be made through an overcast but this is still limited by ceilings and visibilities which are relatively low minima in comparison with present practices. Radio, here, offers the best possible solution of penetrating or seeing through fog and clouds. This fact is proved and full effort is moving in this direction in a strong endeavour to solve the problem which involves the design and behaviour of the aircraft and the study of problems in controlling an aircraft. This is also associated with the development of the automatic electronic pilot and its application to the completely automatic landing. The design and layout of airports, systems of airport control and general navigation will all affect the practicability of blind landing. The general concensus of opinion is that the first steps made should be to obtain a suitable instrument approach system and from this, an absolute blind landing system will follow as an outgrowth after sufficient experience has been obtained by the use of the instrument approach system. The fact remains that an absolute blind landing system right to the point of the wheels touching the ground is definitely possible and will come into use some time in the post-war period. To date the instrument approach system is now particularly well standardized with thousands of let-downs made and with the results that England, the United States and Canada have standardized on one system which will be utilized throughout the three countries.

STANDARD SYSTEM

The system standardized upon was that developed originally by the C.A.A. before the war and is composed of a localizer transmitter and a glide path transmitter which produces a straight glide path. The frequency of the localizer is in the vicinity of 110 megacycles and that of the original glide path was 93 megacycles. Since then, the glide path frequency has been changed to over 300 megacycles. In addition there are three marker transmitters operating on 75 megacycles placed along the approach path of the localizer beam. A permanent installation consisting of a localizer and glide path system for one runway at an airport consists of the following basic units:

1. Runway localizer transmitter;
2. One glide path transmitter;
3. The outer marker transmitter;
4. The middle marker transmitter;
5. The boundary marker transmitter.

One school of thought indicates that the middle and outer markers can be replaced by a low powered, low frequency omni-directional transmitter operating on approximately 278 kc. and using the existing automatic direction finders on the aircraft to be placed in position to fly the localizer, but the author does not favour this idea because of the possible source of interference at multiple airports near large cities.

With the above units the instrument approach system provides the pilot with a straight line lateral guidance to the runway, following the vertical needle of a crosspointer in the cockpit, and also provides the pilot with a straight line glide path, which is noted by the horizontal needle of the crosspoint indicator. This is shown in Figs. 6 and 7.

LOCALIZER

The localizer transmitter is installed in a position approximately 1000 ft. from the up-wind end of the runway. The frequency is between 108.3 and 110 megs. and the signal is modulated at 90 to 150 cycles. The two fields being considered have a blue and yellow colour sector on the indicator for ready reference. The pattern produced is similar to a two-course radio range and is flown as such by visual indication. The blue sector is transmitted to the right of the beam, with respect to the inbound aircraft. The yellow sector is to the left of the inbound aircraft. The normal range of the beam is in excess of 25 miles at an altitude of 2500 ft.—this range increasing with altitude.

GLIDE PATH

The glide path transmitter is installed approximately 1000 ft. up-wind from the approach end of the runway and 500 ft. to one side. It transmits a signal in one direction only at a frequency of approximately 335 megs. The glide path makes an angle of approximately 2½ deg. from the horizontal needle and can be adjusted over a small range for use with various types of aircraft.

MARKER STATIONS

Outer Marker—This unit is placed 3½ miles from the middle station. It consists of a UHF transmitter emitting two dashes per second with a vertical fan-shaped pattern.

Middle Marker—This station is placed one mile from the end of the runway and transmits a signal keyed to six dots per second in a pattern identical to that of the outer marker transmitter.

Boundary Marker—This station, located at the down-wind end of the runway, transmits a steady unkeyed

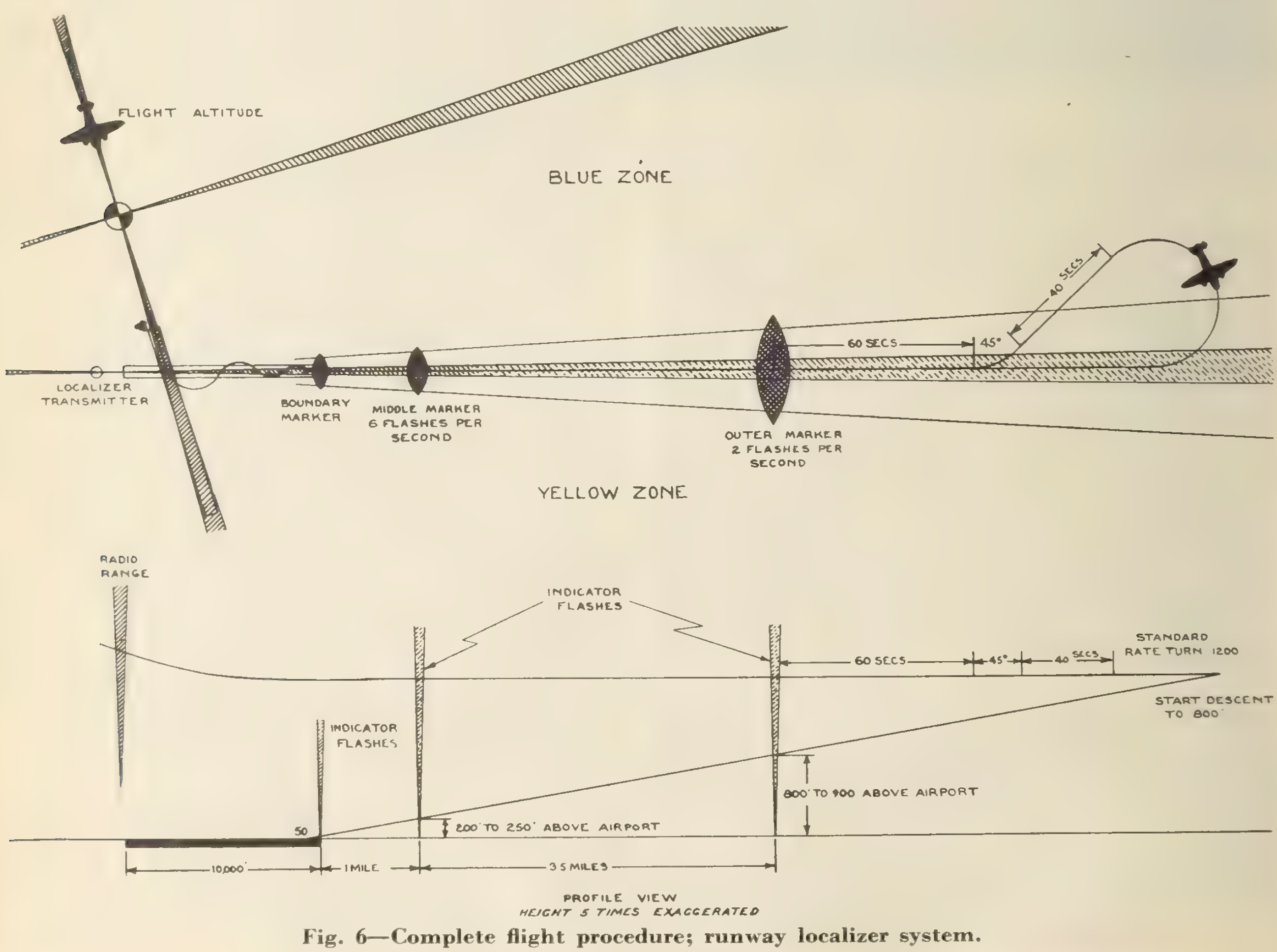

Fig. 6—Complete flight procedure; runway localizer system.

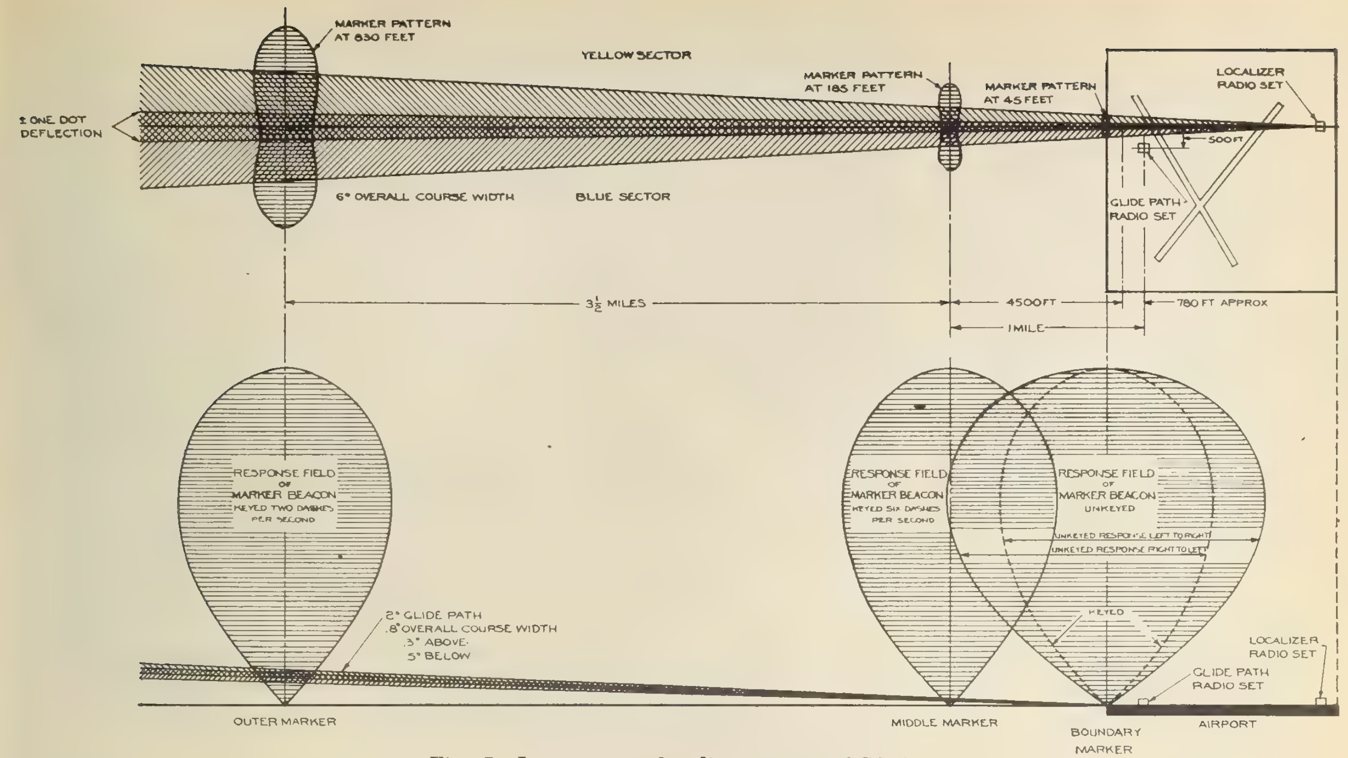

Fig. 7—Instrument landing system SCS-51.

signal and is received on passing over this station when the final approach is made. The pattern transmitted is fan-shaped similar to that of the outer and middle markers.

AIRCRAFT EQUIPMENT

The equipment essential for installation in aircraft to be used in connection with this system is one localizer and one glide path receiver to pick up respectively the two transmitted signals which define a fixed flight index line to the airport. Both of these units are superheterodyne receivers and are reasonably light in weight. Particular importance has been and will be paid to the fact that there is at all times positive indication as to when there is any malfunctioning of equipment associated with this system as it is essential that the equipment either be working accurately or not at all. The marker receivers used in this system could be of the conventional type, now installed in most of our aircraft to receive the cone of silence and various fan markers along the airway. As the receivers are crystal-controlled there is no manual tuning necessary and the pre-setting of the sensitivity does away with the sensitivity control. The only variable control which is given to the flight control is an audio volume if and when the audible means of flying is used. Generally speaking, in flying this system the method of indication used is a cross needle indicator system and the two needles are flown to a centre point at all times in order that the glide path and localizer on-course signal may be followed.

I wish to stress that this instrument approach system project is one that demands first priority in order to expedite a successful conclusion. The economic saving to an operating company in permitting flights to operate safely and to land at designated terminals under instrument conditions that do not now permit them to operate, is tremendous, not to consider the intangible goodwill that could be gained by such operations. Payloads could be considerably increased by reducing the fuel necessary to plan alternate operation, and most important is that the travelling public would be given far more satisfactory service.

Radio Altimeter

GENERAL

The radio altimeter principle was developed before the war as a device to indicate the height of an aircraft above the terrain vertically below. The principle involved consists of transmitting frequency modulated radio waves from the aircraft and receiving the radiation back again in the aircraft after reflection by the ground or water beneath. The receiver provides visual indication of the time taken for one point in the wave-train to make a complete excursion and return, which is directly proportional to the height of the aircraft.

APPLICATION

Some thought has been given to the fact that they might constitute the primary aid to vertical approach guidance supplementing the glide path in an instrument approach system, but experience has indicated it unsatisfactory because of needle flutter caused by obstructions in the path of approach to the runway. These obstructions do not affect the standard glide path field pattern because the pattern is tilted at an angle of approximately 2½ deg. which goes over normal obstructions on the approach to a runway. For this reason a straight glide path is far better for an instrument approach system.

A new and important application for the radio altimeter that promises good possibilities is its use on long non-stop routes such as the Atlantic for "Pressure Pattern Flying". This method, through careful study of meteorological data, makes the winds do part of the work by creating tail winds rather than bucking them. The winds in a high pressure area blow in a clockwise direction out of the middle of the area, while the wind in a low pressure area blows in a counter-clockwise direction into the middle. Thus, if a pilot is planning to fly between Montreal and Scotland, he would study the meteorological data and not necessarily fly the shortest distance, but would fly the course which would give him the most favourable winds. Thus, distances on a trip may be longer than flying a straight line, but the time and fuel consumed would be less. Another important feature is that the weather is much better on the "pressure pattern" route. Economically, a larger payload may be carried and faster time can be made.

The two most important instruments used in this method of flying the isobar lines in a pressure field are the radio altimeter and the barometric altimeter. The radio altimeter would give the exact height above the water and thus enables the pilot to maintain constant altitude, while variations in the barometric altimeter indicate changing air pressure conditions at that altitude. Proper analysis of such changes indicate regions of high and lower pressure and favourable courses to fly in the pressure pattern.

REQUIRED CHARACTERISTICS FOR A RADIO ALTIMETER FOR PRESSURE PATTERN FLYING

(a) *Range*

800 to 40,000 ft.

(b) *Frequency*

Around 2500 megacycles.

(c) *Type of Modulation*

Frequency modulation.

(d) *Accuracy*

An error not more than 3% with a stability within 30 ft. over a period of 15 minutes.

(e) *Indication*

Cathode ray tube. Scale broken down so that accurate readings can be obtained.

(f) *Check*

A pilot's "confidence button" to be included to afford a check, that the equipment is serviceable in the regions where there is no indication on the cathode ray tube.

Rescue Beacons

GENERAL

On long flights over sparsely settled territory, and particularly over water, it is felt desirable to have some sort of emergency portable device, in event of a forced landing, which would send out transmissions for guiding search ships and aircraft for direction finding by coast stations. These signals would be sent out on three frequencies, preferably simultaneously on 500 kc. and two frequencies in the band between 3.95 and 8.58 megacycles. Power is supplied by a hand-driven generator which is built into the unit. for optimum performance, a 200-ft. aerial supported by a kite or a balloon in calm weather is required. The equipment should be waterproof and buoyant. Eventually this would be a device which would make it possible to get distance indication by the rescue ship or aircraft.

REQUIRED CHARACTERISTICS

(a) *Frequency of transmission*

500 kc. and two frequencies in the band between 3.95 and 8.58 megs.

(b) *Modulation*

Amplitude modulation.

(c) *Weight*

35 lb.

(d) *Power Output*

5-10 watts.

(e) *Power*

Hand generator.

(f) *Construction*

Waterproof and as small in physical size as possible.

(g) *Antenna*

Portable kite or balloon aerial.

Collision Warning Indicator

GENERAL

For some time there has been a desire by pilots of aircraft to have some electronic device which would enable the pilot to be warned of the danger of a collision in time to take evasive action. In the present state of the electronic art, this would mean the compulsory installation of electronic equipment in all aircraft flying, regardless of size, to be of full value. The author believes such a device would be helpful, but should be classified as a secondary aid to avoidance of collisions. The primary aid to prevention of collisions should be well established airways in which every aircraft movement in the block of airway is known at all times to the airways controller, who so regulates the traffic within the block that accidents are impossible. It is entirely possible that future devices (now considered secret) will make it possible to furnish a collision warning indicator of light weight which will be of immense value to airline operation.

REQUIRED CHARACTERISTICS

(a) *Range*

20 miles in all directions with a continuous distance indication.

(b) *Altitude*

Should show whether the other aircraft is above or below your flight altitude and be indicated in degrees or preferably in feet if possible.

(c) *Indication*

Pictorial indication on a cathode ray screen together with an indicating lamp or buzzer which would draw the pilot's attention.

(d) *Weight*

Not over 35 lb. complete with power supply.

(e) *Power*

Universal 12 or 24 volt.

Air Traffic Control

GENERAL

The basic purpose of air traffic control is the protection of life and property by the avoidance of collisions. There are protective rules and regulations for air traffic just as there are for ground traffic. Both automobiles and aircraft must be properly constructed, and provided with necessary safety equipment before they can legally operate. The secondary purpose of air traffic control is the expeditious movement of traffic. Delays encountered along an airway or in the vicinity of an airport cause a definite measurable monetary loss, because every excess minute spent in the air means so many dollars and cents loss for fuel, wear and tear and other expense. Air traffic control must, therefore, be designed to keep traffic flowing evenly and with as little delay as possible.

Problems of traffic control for aircraft not moving in accordance with definite, predetermined flight plans would be insurmountable. With their paths crossing almost anywhere the situation would lend itself to the

Fig. 8—A typical Department of Transport airport control tower.

danger of collision even on bright, clear days. For this reason airway traffic between terminals is strictly controlled. Airway traffic control so organizes the movement of aircraft in advance that no danger of collision can arise if they proceed in accordance with instructions.

In conjunction with airway traffic control there is also airport traffic control which is localized in a small zone around an airport terminal for the purpose of providing the necessary safe separation for arriving, departing and taxiing aircraft. It is important to note that efficient airport control depends largely on efficient airway traffic control which extends out along the entire airway system.

With even the present air traffic and certainly with the anticipated post-war traffic there is definitely a need for improved methods and facilities other than the manual procedures now used by air traffic control centres. Here is where new radio and electronic aids will play an important part in the post-war period. The present system of manual airway control is utterly too slow and cumbersome. It is characterized by the fact that once confusion begins, it grows out of proportion rather than correcting itself because of the human element that is associated with the system. This is particularly true in instrument and borderline weather at times when peak traffic occurs on busy airways.

REQUIRED CHARACTERISTICS

Generally it can be stated that in the post-war period all airline operators would desire to see a completely automatically operated airway traffic control system which is reliable and efficient. Our problem here is somewhat similar to the problems the railroads were once faced with, except for the three important differences, namely, the speed of an aeroplane, the three dimensional movements possible, and the fact that the aeroplane must remain in motion at sufficient speed to maintain altitude and manoeuverability. Nevertheless, much can be learned by a close study of the railroads' own problem and a modified system such as they use needs only the application of radio and electronic techniques, some of which are secret at present, for complete accomplishment.

A flight to be conducted with maximum safety along a block of airways must have complete information relative to another aircraft in that area. It is not sufficient to know just the relative position of aircraft ahead. One must know what is at other altitudes above and below, what is behind, and laterally either side instantaneously and continuously without the necessity of changing normal flight in any manner. The most satisfactory indication of this would be an appropriate indicator. The required cockpit indications for such a system are as follows:

1. "Proceed";
2. "Hold";
3. "Climb";
4. "Descend";
5. "Slower Ground Speed";
6. "Faster Ground Speed";
7. Distance of other aircraft in the block;
8. Azimuth heading of other aircraft in the block.

It is imperative that the above indications be continuously shown on some type of screen in the cockpit. Such indications must be displayed simultaneously and continuously to each aeroplane under control in the airway block. By the use of very high frequencies, such transmissions can be limited to one block by shielding ground antennae so that signals in that block only can be received.

Converging and intersecting airways should be differentiated by providing automatically keyed interrogation on the aircraft with suitable decoders in the ground equipment. If necessary, multiple beacons could be provided at each location to allow operation on different frequencies for each altitude under control. By use of keyed interrogations to differentiate airways by the use of standard altitude frequencies and breaking airways into blocks according to range and beacon locations, it becomes possible to transmit the coded cockpit indications to an aeroplane that is between any two beacons at a specific altitude.

Means must be provided whereby occupancy of a block at a specific altitude acts automatically to hold a relay on the ground beacon whereby "block-altitude" occupancy is shown to all traffic on that particular altitude. All movements, including that at intersection or points of conversion with other routes, is interlocked by automatic ground signal equipment so that the first plane to enter an area automatically takes the right of way and the signal indications are such to hold any conflicting traffic, particularly if there is no clear channel to which this intersecting traffic can be cleared.

It is important that in congested areas, the automatic system be so set up, separation between flights in the same horizontal plane is known to the pilot at all times and also that if necessary, he may change his altitude or route at his discretion without reference to the ground station and still have the automatic protection of knowing that the aircraft, through the safety devices of the system, can change altitude with absolute safety. For instance, a pilot wishing to descend needs only to switch his interrogator to the next altitude below and read the indication of the next beacon. If it is "normal", he may descend, switching his equipment to show his own occupancy of the new altitude. In the same manner, a flight can insert itself from any 'off the airway' position. It is realized that information will still have to be taken from basic signal systems at key points and displayed for a centralized information centre. At this point, a controller will only monitor the system but can exercise his overall control (when required) by means of controlling the basic signal system in a restrictive sense. That is, he will be able to, for example, hold an indication in front of one flight thereby making it possible for another flight to automatically be permitted to overtake the first flight and proceed along the airways. It should also be possible to include, as part of the automatic airway traffic control system, a method whereby climb and descent is automatically shown on the air controllers central flight information board, and for the controller to issue necessary climb or descent instructions.

In the concluding remarks on airway traffic control it can be stated that radio offers the only solution to a satisfactory and totally automatic system which would be considered essential to efficient airline operation. Many problems remain to be worked out in the post-war period but the techniques involved are within the present state of the art.

Fig. 9—Model 19 semi-automatic teletype equipment used by Trans-Canada Air Lines.

Wired Teletype

GENERAL

Wired teletype offers a rapid communication service between and along points on an airway route in the form of a printed message. No technically skilled operator is required. It has a great advantage in that it is simply a matter of running an automatic teletypewriter in one place and having it print in another at a rate of 60 words per minute. Teletype communication systems are, and will continue to be important in the post-war period because they furnish two essential functions; first, a Government service in the collection and distribution of weather information, and second, a service known as "company teletype" which is operated by the company concerned for their important operations business traffic, for which faster service is required than via commercial telegraph service.

Improvements Required In Post-war Period On Teletype

Speed. A greater speed of operation of teletype machines is deemed essential as the traffic to be handled is continuing to grow and in the post-war period a great increase is expected. The present machines operate at a speed of 60 to 75 words per minute. It is felt that this speed should be brought up to at least 100 words per minute. This can be accomplished by improved techniques on land line facilities.

Automatic. Circuits and machine should be completely automatic with regard to relay of messages.

Noise. The present teletype machine such as the Model 19 has a noise level of approximately 75 db. which causes disturbance and fatigue to nearby personnel in some of our traffic offices. A desirable noise level would be a maximum of 55 db. which is the level of the noise in the average office.

Radioteletype

GENERAL

Before the war there was some work done on radioteletype, but only in the last four years has the technique been brought to a practical level. In long distance communication, especially over distances separated by large bodies of water where direct wire communication is not possible, the radioteletype offers the only solution for machine-printed messages. Economically, radioteletype sometimes also offers a better operating solution than wire lines, particularly between two long distance points. Before the advent of radioteletype, there were generally three ways of establishing this type of communication. They were as follows:

1. Direct voice.
2. Manually-operated C.W. circuits.

3. Automatically operated code circuits for both transmission and reception.

The disadvantages of all three of the above methods of transmission and reception are quite apparent. Voice operation is effective only when the signal is at comparatively high level and in a common language. Manual C.W. circuits require a signal that can be heard and understood by the human ear making necessary skilled operators at both ends. Automatic C.W. circuits, while probably the most effective of the three methods, still require trained operators at the receiving end, and these operators are subject to fatigue and exhaustion not characteristic of machines. Radioteletype overcomes the above difficulties to a great degree and for this reason will find a definite application in the post-war period of airline operation.

Wired Telephone

GENERAL

As the speed of the aeroplane increases, more and more stress is, of necessity, placed upon speed of communication. Teletype, while providing a rapid means of communication, still does not satisfactorily compete with a telephone circuit conversation (for certain purposes) between two points or two persons as, normally, the rate of speech is approximately 260 words per minute, which is four times faster than most teletype circuits. In certain circumstances this factor is important and may influence the ultimate decision to use telephone over other means of communication.

One point in favour of telephone is its use for reservations between cities enabling airlines to give prospective customers the fastest possible type of service in answer to enquiries as to whether space is available to desired destinations. Here, particularly where competition is a factor, it is of utmost importance to be able to give this answer quickly in order that sale of the seat is completed before a competitor has a chance to change the customer's mind.

Another important factor is the use of direct telephone circuits in the field of very high frequency two-way communication, where there is a direct telephone line between a series of cities along a route making possible a common conversation between the aircraft and all stations in that particular sector. Briefly, if the line of sight distance is too great for direct VHF transmission from aircraft to interested ground stations, then a strategically located VHF ground unit (possibly unattended) picks up the radio signal and relays it automatically over wired telephone circuits to distant ground stations. When such a circuit is used any two-way communication along a route will be heard by all ground stations in that sector making them totally aware of all information that passes between ground to aircraft or from aircraft to ground. At centralized flight control points, a flight controller may control a number of flights over a route by means of verbal instructions to various ground stations in such a manner that all aircraft are kept continuously advised of instructions and information necessary for a safe and efficient operation.

DISCUSSION

B. J. Vierling[1]

The instrument approach and instrument landing system described so well by Mr. S. S. Stevens offers the greatest single advancement available to air transportation today. He has proposed a very sound system whereby a pilot landing an aeroplane at Winnipeg, Ottawa, Washington, Chicago, or any other city on a regular airway would follow one standard approach and landing procedure. The universal use of such a basic system would make instrument landings routine and thereby give air transportation its greatest possible increase in operating efficiency today.

Although he has not said so in his paper, I am sure Mr. Stevens must feel as I do that, until a suitable instrument approach control and instrument landing system is put in operation by the various airlines in conjunction with and with the assistance of the proper Government agencies, there is little need for us to concern ourselves over the development of 300 or 400 mile-an-hour aeroplanes—or even some of the ships presently being designed for operation at supersonic speeds.

Many people in our industry have become so enthusiastic in their campaign to reduce the weight empty of transport aircraft that they have overlooked completely the possible increase in aircraft utilization, increase in payload, and increase in overall air travel and air shipment which can be obtained through the judicious investment of a few relatively light-weight radio-navigation instruments. Our industry has grown to accept the addition of 600 or 1,000 lb. of extra fuel on certain trips as being essential without realizing its effect on our overall earning power or its effect on the prospective passengers that were removed from the individual trip involved to make room for the additional fuel.

Our aircraft manufacturers have done a splendid job in developing aerodynamically clean aeroplanes which are capable, once in the air, of attaining much greater economy than was previously believed possible, but let us see what happens to this economy under an operation where efficient approach control and instrument landing facilities are not available. It might well be said that the efficiency of these aeroplanes exists after the aircraft is in the air on an individual trip and continues to exist until it arrives at a point 200 ft. above its destination. Unless we are able to get that aeroplane quickly and safely down to the airport runway, we eliminate all of its advantages of economy that might have been gained enroute.

Aeroplane efficiencies must be controlled on a gate to gate basis rather than on the basis of normal cruising flight time between points. It does the passengers or cargo no good whatsoever to average 200 or 300 miles an hour from Vancouver to Ottawa if, on arrival over Ottawa, the aeroplane is forced to spend an hour or more circling Ottawa because it is unable to navigate the last 200 ft. down to the airport runway.

The operation of a Douglas DC-3 aeroplane on our route between Pittsburgh, Pennsylvania, and Washington, D.C., is scheduled for one hour, 10 minutes. This means that the aeroplane has a block-to-block speed of approximately 160 m.p.h. for the trip. Under adverse weather conditions, it is not uncommon for that same trip to be held up because of airways traffic so that the trip actually required 2 hours flying time, thus reducing the average speed from 160 m.p.h. to 93 m.p.h. Now if we were to use an aeroplane capable

[1]Chief Engineer Pennsylvania-Central Airlines Corporation, Washington, D.C.

of making this trip at 300 m.p.h block-to-block speed and were forced to accept a similar delay in landing at Washington, the average speed would be dropped from 300 m.p.h. to approximately 128 m.p.h. A delay of this magnitude is entirely possible with existing airline facilities and as our aircraft become faster, the relation between delay and flight time will become proportionally greater. Delays of this nature are not only inconvenient to the traveller but are extremely costly to the air carrier.

Aeroplane direct operating costs are incurred on an hourly basis. An aeroplane which costs x dollars per hour to operate and operating at a block-to-block speed of 200 m.p.h. costs $\frac{x}{200}$ dollars per mile direct operating cost. If the aeroplane is held up at its point of destination because of adverse weather conditions and is forced to wait an additional hour in the air, then the average block-to-block speed has been reduced from 200 m.p.h. to 100 m.p.h. and the cost increased to $\frac{x}{100}$ dollars per mile. The revenue received by the airline operation for such a trip would be based on a block-to-block speed of 200 m.p.h. and, therefore, although there would be no increase in revenue received, the airlines costs would have been doubled. On some occasions the ship might be made to return to its point of origin because of adverse landing conditions at its intended destination, thus causing the operator to fly twice the normal flight distance for which he receives absolutely no revenue. Needless to say, passengers object strenuously to this type of operation. Thus, it can be seen that it is entirely possible for an airline operator, under present conditions and with present facilities, to have his costs vary by more than 100 per cent purely because of adverse weather conditions along the line.

It is obvious, I am sure, because of such possible variations in operating efficiency, that it is necessary for the airline to protect itself in establishing its rate to cover for such unforeseen increases in operating costs. During the year 1944 our own company's operating efficiency was reduced by approximately 9 per cent throughout the entire year purely because of cancellations caused by adverse weather. The remaining 91 per cent of our operation was less efficient than it should have been from an average speed and cost per mile standpoint because of delays enroute caused by ships having been held out of stations because of airways traffic and the accompanying delays in permitting ships to land at their destinations. This additional reduction in efficiency would amount to perhaps between 2 and 5 per cent of our total operation. Therefore, it can be said without question that with existing incumberances in our normal operation we have at least an average 10 per cent loss of efficiency throughout the year, which certainly increases our cost of operation. There can be no question that this provides ample room for improvement, and it can be safely said that if it were possible for us to guarantee a 100 per cent operation throughout the year we would be in a much better position to offer more economical transportation and much more dependable transportation than is possible today.

There is no doubt in my mind that the improvement in airline operating efficiency which could be brought about by the standardization among all carriers on an approach control and instrument landing system, the pattern of which would be identical at all airports, would permit an increase in aircraft utilization, an increase in scheduling, and dependability of service, which would permit all operators to provide attractive rate reductions to the travelling public. The aim of all airlines is, I am sure, to provide fast, dependable transportation at as low a rate as can be economically justified. A standardized approach control and instrument landing system such as that proposed by Mr. Stevens is the most concrete means I know of attaining that goal.

Captain S. P. Saint[2]

The approach to the overall problem of air navigation and traffic control in Mr. Stevens' paper is very well considered. We are particularly interested in his analysis of the long range aspect of air traffic control. This problem should be of the greatest concern to operators since it will have more bearing on safety factor and efficiency of scheduled operation than any other item. We believe that the plan of future development along the lines of block control as outlined by Mr. Stevens represents the only real and practical approach to the problem yet presented. The application of these theories to traffic control and the immediate investigation of the implementation suggested should be given the highest priority. It is recommended that this effort be coordinated with a group within the United States which is currently conducting a parallel study.

W. E. Fenn[3]

While there seems to be some tendency on the part of airline personnel to consider the low frequency Adcock type of radio range as obsolete, we must not overlook the fact that it has proved to be reliable during the last ten or more years of operation.

It is agreed, however, that the VHF type of radio range for airline use over land route has certain advantages.

In postwar years, when private flying again becomes permissible, it is this discussor's opinion that the low frequency simultaneous radio range will still be in demand and serve a very useful purpose. For privately owned aircraft, and also commercial aircraft which would not be flying fixed routes, the low frequency omni-directional range would appear to offer certain advantages. It is our understanding that this low frequency omni-directional radio range is being developed at the present time, along with the omni-directional VHF radio range.

The low frequency simultaneous or omni-directional radio range would appear to be more effective for private flying on other than fixed airline routes because, at this low frequency, the coverage would be better than that provided by the VHF radio range.

Since the weight of radio equipment in small aircraft must be kept at a minimum, it appears that the low frequency simultaneous or omni-directional range in certain sections of the country would best suit the needs of the private flyer.

The VHF radio range would, of course, be available to the private flyer along certain airline routes, but whenever the private aircraft was required to fly other than these established airline routes, it would mean carrying another lower frequency receiver for naviga-

[2] In charge of airways traffic control, American Airlines Inc., New York.

[3] Air Services, Radio Division, Department of Transport of Canada, Ottawa.

tion and communication facilities when off these main airline routes, because of the limited coverage of the VHF radio range.

Regarding vertical as against horizontal polarization in connection with the VHF radio range, we would like to mention that according to reports received, insufficient tests have been carried out to conclusively prove that one type of polarization is superior to the other.

As pointed out by Mr. Stevens in his paper, the VHF radio range receiving antenna installation on the aircraft would be comparatively simplified if vertical polarization were used. This would also apply, in my opinion, to the actual VHF radio range antenna system.

Regarding the glide path antenna system, reports indicate that it will be necessary to employ horizontal polarization, as trouble is encountered at the end of the concrete runways, due to discontinuity in ground conductivities when vertical polarization is employed.

J. A. T. Butler, m.e.i.c.[4]

The greatest impediment to the advancement of air travel is undoubtedly the too frequent interruptions of service due to prevailing weather conditions. Mr. Stevens has indicated in his very excellent paper how the latest developments in radio and communications will go a long way towards eliminating this handicap. As an aeroplane designer, however, I foresee many serious problems ahead in installing all the necessary apparatus in or on the aircraft. In particular, the number and size of the external antennae will have a serious effect on performance. New developments in radio and radar have come so rapidly during this war that a piece of apparatus is often out of date before it reaches the market in quantity and it is difficult to say what final form this apparatus will take. However, it is obviously most desirable that the installation of this apparatus in future aeroplanes be given careful consideration in the early stages of the design and it is, therefore, essential that the airlines decide in detail as soon as possible what equipment they will require.

The Author

Mr. Vierling points out that an instrument approach system is one of the basic needs of air transportation today to increase operating efficiency. In this we concur, and might add that radio guidance in its present form is the only solution to the problem of instrument approach at terminals where weather conditions are below the operating minimum as now standardized by the air industry. It is only with the installation of instrument approach systems that we can put air transportation on grounds comparable to other modes of transportation, and assure the passenger of arriving at his destination on a pre-designated time. Coupled with this great aid to the promotion of sales for air transportation would be the fact that the additional gasoline load now being carried for alternate terminals could be substituted for revenue load. With larger aircraft in the offing, it is of paramount importance that the fuel requirement be kept at a minimum in order that the highest possible revenue load may be achieved at all times, thus allowing full depreciation of the aircraft within a reasonable length of time. We will then be in a position to follow the future trend of new designs that will become available due to research in the aeronautical science.

[4]Chief Engineer, Fairchild Aircraft Limited, Longueuil, Que.

The SCS-51 instrument approach system does not really represent the ultimate, which will of course be absolute blind landing in zero-zero conditions. Nevertheless, it is a very definite step in the right direction to fulfill an immediate need for greater regularity of schedules. The SCS-51 does not preclude the use of other aids, such as visual marker guides or marker approach lights, all of which must be engineered into the appropriate approach system, in order that all known techniques may be utilized to ensure the best possible and efficient solution to the problem. Correct approach lighting is an absolute necessity with the radio instrument approach system because by this means only can a pilot transfer from radio guidance to visual contact flight and overcome the psychological disadvantages which are apparent when only radio guidance is relied upon. The future technique of radio guidance will be an absolute automatic landing by means of electronic automatic pilots, in conjunction with the instrument approach system to complete the picture.

With Captain S. B. Saint's comments, I can most heartily agree. Air traffic control and the airport system is a problem of great concern to the operator, and most definitely has a bearing on the safety and efficiency of scheduling postwar air operations. There is little question that some arrangements for airways traffic control based on a block system will be devised to ensure efficient handling of high density traffic. It is only in this way that the necessary coordination of all elements present in the problem can be achieved. Captain Saint is a pioneer in this field, and airline operators look with interest to the solution of the work that he has started.

Mr. Fenn indicates in his comments that private flying will make definite use of the omni-directional low-frequency range. With this I am inclined to agree, particularly in view of the fact that the low-frequency omni-directional range has the advantage of covering a greater distance under good atmospheric conditions than VHF, which is limited to line-of-sight transmission. Nevertheless, at the present time experiments on a low-frequency directional range have run into serious difficulties and it is not known whether these can be overcome. The small aircraft in postwar days will certainly have to carry a limited amount of radio equipment and it is felt that, from an economical standpoint, this equipment should be detailed enough to enable the use of radio navigational facilities which offer such advantages as static free reception, etc., in the VHF spectrum. Certainly they should carry VHF two-way communication equipment, in view of the limitations imposed upon the power output in such aircraft. VHF offers a far more satisfactory solution than HF communication. In addition, they will possibly have to have an interrogating device, enabling ground-airway control points to know at all times their position in relation to a designated airway, and also have the necessary navigation receivers to be used in conjunction with flying airways.

RECENT DEVELOPMENTS IN THE FIELD OF MATERIALS AND PROCESSES

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Paper presented at the Fifty-Ninth Annual General and Professional Meeting of The Engineering Institute of Canada, at Winnipeg, Man., on February 8th, 1945.

SUMMARY—In this paper the author discusses a few of the recent developments in materials and processes which are of interest to airlines as well as other industries.

Aluminum alloys with 74% improvement in yield strength over heretofore standard high strength alloys, are now in production. Natural aging high-strength aluminum casting alloys are also widely used. The birth of the National Emergency steels has enabled the allied nations to produce enormous tonnages of heat treatable alloy steels, in spite of decreased supplies of some imported essential alloying elements. In the realm of non-metallic materials, the impregnated wood veneers, plywoods and plastics point to a whole new horizon of applications for these classes of products. Adhesives capable of joining metals, plastics, glass, fabrics, etc., in any combination, are found to give joints with higher shear strengths than conventional riveted joints. Fuels have also been the subject of considerable study and research. The octane rating of present fuels has been boosted to 140 and a new fuel capable of developing four times the power of our present 100 octane fuel is being produced on a small scale for experimental purposes. Shot-peening is now holding the attention of manufacturers as a means of increasing fatigue resistance of stressed parts. Lead is finding wide acceptance as a corrosion-preventive coating for steels. New heat treatment techniques facilitate the treating of heavy and complicated parts while they decrease the danger of cracking. As a surface hardening technique, induction heating is finding wide acceptance. Cold treating and chromium plating are also doing their share in boosting the life of tools and parts.

Introduction

During the past few years, war demands have spurred and, perhaps, compelled the development of scores of new materials and techniques. Many of these new developments have been picked up by the press and widely publicized; others, however, still remain hidden from the public by a veil of secrecy. Because of serious shortages in certain basic materials, engineers have been forced to develop and experiment with substitutes, which sometimes have proved to be more satisfactory than the original materials. On the other hand, many of these substitutions have been found to be pure makeshifts and the manufacturers will return to the original material as soon as it becomes available. The universal search for satisfactory substitutes, however, has resulted in a general awakening of plant engineers to the possibilities of materials with which they were relatively inexperienced. Not only have materials been explored, but existing fabricating processes have been reviewed, and others, built around the properties and characteristics of new materials, created.

The war has served as a great proving ground for these newly developed materials and processes and has made it possible to accumulate considerable data on large scale experiments and operations.

Of necessity, the author has limited his discussions to a few of the most recent and newsworthy developments. No attempt has been made to present a picture embracing all these nor at making hair-raising predictions. Certain pertinent data and information have been presented and the reader may draw his own conclusions.

Aluminum Alloys

Perhaps most outstanding in recent years has been the development of new aluminum alloys which give a new freedom to the strength weight factor. The price of energy is gradually rising as shortages of fuels become more pressing, and the light metals find more applications because they permit substantial energy savings by reason of their lightness compared to other structural materials. Detailed consideration of typical cases brings to light the economies which can be achieved in fuel, power consumption and wear and tear by the substitution of these high-strength aluminum alloys for iron, steel and bronze.

Production of aluminum and its alloys has been stepped up tremendously since the beginning of the war, to a point where, today, our production is roughly eight times that at the beginning of the conflict. Most of this increased production has been absorbed by aircraft manufacturers who have stepped up production for a while, at a rate faster than aluminum could be produced.

The newest high strength aluminum alloy is as yet available only in the form of extrusions and alclad sheet but, undoubtedly, other commodities will be available in the near future. This type of alloy, which is identified as Alcoa 75S, 76S and Reynolds R-303, has the highest tensile strength that is available today in any aluminum alloy. The new aluminum alloy is a zinc-magnesium type containing between 5 and 10 per cent zinc. Its exact analysis, however, cannot be revealed at this time for security reasons.

In the clad form, its attributes are those of a high strength, light weight material, with corrosion resistance comparable to that of pure aluminum. Its physical properties, however, are very much superior to the conventional high strength alloys such as Alclad 24ST. It is easy to fabricate, can be heat treated and offers many advantages over those of the 24ST alloy. Typical mechanical properties, as quoted by the Aluminum Company of America, are given in Table I. For purposes of comparison, the corresponding values for 24ST are also given.

TABLE I

	75 ST	24 ST	% Change in properties over 24 ST
Ultimate Tensile	88,000 psi.	68,000 psi.	+ 29.5
Yield	80,000 psi.	46,000 psi.	+ 74.0
Elongation	10%	22%	— 12.0
Hardness	150 BHN	120 BHN	+ 25.0
Shear	47,000 psi.	41,000 psi.	+ 14.6
Endurance Limit	22,500 psi.	18,000 psi.	+ 25.0

The heat treatment practice for this alloy is similar to that for other heat-treatable alloys, i.e., the alloy can be annealed, solution and precipitation treated (artificially aged). An advantage which this alloy has over other heat treatable alloys, is that the recommended solution temperature of 940 deg. F. is considerably below the melting point of the eutectic component, which means that the alloy may be over-heated to a degree without damaging it. Other strong aluminum alloys, when overheated by a few degrees above the recommended temperatures, are ruined irreparably by eutectic melting.

After the solution treatment, 75S ages naturally at a rapid rate in the first four or five hours but develops a yield strength of only about two-thirds of the required value after one-month's aging at room temperature. Consequently, artificial aging at a temperature of 250 to 350 deg. F. is required, if maximum physical properties are to be obtained.

(Aluminum Co. of America, Pittsburgh, Pa.)
B-29 Bomber in which the 75S aluminum alloy is used extensively

Because of its high strength, some of the fabricating procedures which are used with other alloys, such as 24S, do not necessarily apply to working of this new alloy. In the as-quenched temper, the alloy can be formed almost as well as 24 SO, providing the forming operation is done immediately after quenching, and before natural aging of the alloy has progressed too far. The alloy can be formed, however, in the " W " and " T " tempers but, in this condition, it requires generous bend radii as for most other strong alloys when worked in the same temper.

This alloy can be torch, arc, spot and seam welded, riveted, dimpled, anodized and painted like any other strong aluminum alloy.

Another noteworthy addition to the family of aluminum alloys, is the 5.25 per cent zinc, natural aging alloy. A natural aging aluminum alloy is relatively new to industries which have been accustomed to depend upon heat treatment to obtain high strength. This alloy which permits high strength to be obtained without any high temperature solution or quench treatment offers many advantages over heat-treated alloys by accomplishing the following objectives:

(1) Quenching stresses and cracks are avoided.
(2) Warpage due to high temperature treatment and subsequent straightening is avoided.
(3) Heat treatment equipment is not required.
(4) Welding, brazing or soldering processes do not alter the physical properties of the alloy.

The approximate chemical composition and physical properties of this casting alloy are shown in table II.

It will be noted that this alloy has properties equivalent to, or better than, those obtained from other high strength, heat-treated casting alloys.

Another outstanding characteristic of this alloy is its ability to re-age when cooled to room temperature after exposure to high temperatures, the properties not being altered by this exposure. This property is of particular importance when castings are to be brazed. Since brazing involves heating to above the annealing temperatures for aluminum alloys, parts made from non-heat treatable alloys must be designed on the strength of the soft temper of the material while, in the case of heat-treatable alloys, the parts must be reheat-treated with the attendant disadvantages of warping, cracking, etc. The use of 5.25 zinc alloy, however, eliminates these problems.

This alloy has excellent corrosion resistance and exceptional ability to withstand shock.

Steel

The advent of the war and consequent enormous increase in the demand for steels of high strength, and particularly the reduction in the availability of certain alloying elements, constituted a challenge to the steel industry of the allied nations. The ingenuity and resourcefulness of our metallurgists met this challenge.

In the field of structural steels, little if any development has taken place. The fact that these steels have been designed with low alloy content, is responsible for the lack of development in these steels, since little would be gained in finding new combinations.

The heat-treated alloy steels, however, have been the subject of intensive study and considerable development. This gave birth to a brand new series of steels lean in alloy content and known as the National

TABLE II

% Zn.	% Mg.	% Cr.	% Fe.	% Ti.	% Cu.	% Si.	% Mn.	% Al.
5.25	0.50	0.50	1.0 max.	0.2	0.4 max.	0.3 max.	0.3 max.	Remainder

Ultimate tensile	32,000 psi.	Modulus of elasticity	10,000,000 psi.
Yield	22,000 psi.	Endurance limit	9,000 psi.
Elongation	3%	Charpy impact	2–3 ft.–lbs.
Hardness	70-80 BHN		

Emergency (NE) steels. In order to offset the shortages of such alloys as nickel, chromium, tungsten, cobalt, manganese, vanadium and molybdenum, these steels were designed to utilize to their utmost the beneficial effects which these alloying elements have on iron-carbon alloys. Metallurgists have known for a long time that two or more alloying elements are more effective, in strengthening a steel, than the same amount of one alloying element. It was believed, however, that steels containing a small quantity of many alloying elements would not respond to heat treatment as well as a temary steel, i.e., a steel which derived its strength from one main alloying element. The war, however, has definitely shown that steels in the former category, do heat-treat well. It was found that hardness is a function of the carbon content of the steel, while the alloying elements provide the depth of hardness.

As mentioned above, the National Emergency steels were designed to conserve strategic alloying elements and this is accomplished by a better balance between the added alloying elements and those which are present in the scrap returning to the mill for remelting. It may be mentioned in passing that some of these steels, which have properties comparable to the old standard steels, will probably be retained in the post-war period because they are less expensive by virtue of their lower alloy content. It may also be said that for many years after the war, scrap for remelting will contain these alloys and will contribute towards rendering the production of single-alloy steels of the manganese, molybdenum and nickel types more difficult.

Wood

It seems that scientists are taking a new interest in this material, with the result that in the past few years many important discoveries and technical advances have been made. A whole new horizon has been uncovered which points to almost unlimited possibilities for the uses of this material. Not only have the properties of older wood products been improved, but entirely new products have been created.

In the field of glued veneers, aircraft design requirements occasioned the first real exploration of the strength-weight ratio of plywood. Glues as strong or stronger than the wood itself have been developed, and it is found that these new plywoods have many desirable features as an aircraft material. New plywoods are easy to curve, form and cut. They are non-splitting, inexpensive and can be obtained in large quantities. Development of liquid phenolic resins by the plastics industry is largely responsible for the recent advances of plywood as an engineering material. These phenolic resin glues are used in two ways, as a dry film or as a liquid. In the case of the dry film, thin sheets of the glue are inter-leaved with the veneer layers. The assembly is then heated and pressed for approximately 10 minutes at 300 deg. F. The pressure varies somewhat with the density of the wood, and the time with the thickness of the veneer. The so-called high-density plywoods are made by applying liquid phenolic resin, pre-drying and then hot pressing as in the case of the dry film. The pressure, however, is much greater, being of the order of 1,000 lb. per sq. in. The properties of this type of plywood permit the meeting of design requirements far in excess of the range of normal plywoods. It may be mentioned in passing, that phenol-formaldehyde resin adhesives yield the most durable plywood. This adhesive, however, is not adequate in assembly work because of its low heat reaction. Another type of resin, namely the urea-formaldehyde type, fills this gap. The latter resins are cold setting and, when mixed with a suitable catalyst, will cure at a room temperature of 70 deg. F. A better joint, however, is obtained when the glued assemblies are cured at a temperature of 140 deg. F.

Plywood can be formed to almost any shape desired. Aeroplane fuselages, wing tips, pipe and corrugated sheets are but a few examples.

Processes have been developed by means of which the very properties of wood are changed, yielding entirely new substances. Strength, resistance to destructive agencies, dimensional changes and many other factors can be regulated at will. Our lightest woods can be made stronger than our strongest natural woods by impregnating the wood with resins which are subsequently made to set under heat and pressure.

Wood can also be plasticized through an impregnation process which renders the treated wood susceptible to forming and shaping at elevated temperatures but, upon cooling, reverts to its natural properties.

Considerable development is being made in gluing and seasoning of wood by means of induction heating which heats the centre of the wood package just as rapidly as the surface.

Some mention should be made of the new composite laminated woods, such as plywood, containing layers of paper, glass cloth, cloth, metal foil, etc. These layers of foreign material are incorporated for strength reasons or, when on the surface, as brightly coloured inlays or films for decorative purposes.

Delignified impregnated wood, while still not much more than a laboratory curiosity, seems to offer great possibilities. Because of its low density and unusual strength-weight relations, it is probable that this material, which was developed approximately two years ago, will appeal to aircraft and other weight-conscious industries. This material is produced through a process known as " delignification ." which is very similar to the " digestion " process used by the paper making industry. The wood veneer is immersed in a solution, which, under heat and pressure, dissolves or converts the lignin and hemicelluloses of the wood, leaving the cellulose wood structure intact. The delignified wood is then impregnated with natural or synthetic resins which act as a cement between the cellulose fibres. The delignified veneers are simply immersed in the resin bath for a few minutes, then stacked wet to allow diffusion of the resin into the wood cell walls. They may then be dried and are ready for fabrication. By controlling the drying process, it is possible to produce veneers with the flexibility of leather, which can then be easily formed and subsequently cured. Delignified impregnated woods are characterized by exceptional strength-weight ratio and dimensional stability. The final product is hard and infusible.

Plastics

In the past few years, the plastics industry has received perhaps more attention from the press than any other industry. This is probably due to the fact that much research in this field has resulted in the development of a host of new materials. These new materials, which offer wide ranges of properties, have found applications in a great number of industries. The author would venture to say that the publicity given these developments was perhaps not in proportion to their importance when compared to the developments which have been made in other fields. No one can deny, however, that much welcome progress in plastics has been made. In fact, it would be a bold man who would attempt to dogmatize upon the future of so young an industry. The war has taught plastics manufacturers lessons, which will, no doubt, tend to curb unbridled enthusiasm and redirect the industry towards the vast mass production for which it is destined. The colour and decorative qualities of plastics should perhaps be considered as secondary to their behaviour and strength at temperatures of —70 to +200 deg. F., electrical properties, dimensional stability, toughness as well as cost and ease of fabrication.

An attempt at covering all new developments in plastics is beyond the scope of this paper. A few, however, will be mentioned.

One newly developed class of plastic, which seems to offer great possibilities, is the so-called " silicones ". These substances combine an inorganic element, silicon, with organic radicals, composed of carbon and hydrogen, to produce groups of plastics which have the ability to maintain their properties over wide ranges of temperatures.

Some of these silicones are fluids with properties which render them eminently useful as hydraulic fluids. Their outstanding characteristic, when used as such, is that much smaller changes in their viscosity are observed when subjected to temperature changes than with our present petroleum-base fluids. These fluids which can be produced in a number of viscosities, are transparent, colourless and highly resistant to oxidation. They are immiscible with water and have no effect on plastics, rubber and synthetic rubbers, even at high temperatures.

Silicones are also produced as a resin-like material which can be applied as a varnish. After baking, the resin has a melting point close to 500 deg. F., which suggests the suitability of this material in electrical insulations, where high temperatures may develop.

A third class of silicone products consists in a number of greases which have been found to maintain good consistencies at extremely low temperatures and retain satisfactory viscosities at high temperatures.

The versatility of the silicone plastics certainly points to their eventual wide acceptance for applications in industry at large, and particularly in aviation where extreme changes in operating temperatures are one of the major items of trouble.

Polectron is another new member of the plastics family which is now making a valuable contribution to our war effort. This material is a synthetic replacement for natural mica, which, because of its applications in radio and electronic equipment, is one of the most critical war materials. Polectron has low dielectric loss, high temperature stability and superior water resistance. Its mechanical properties, however, are relatively poor.

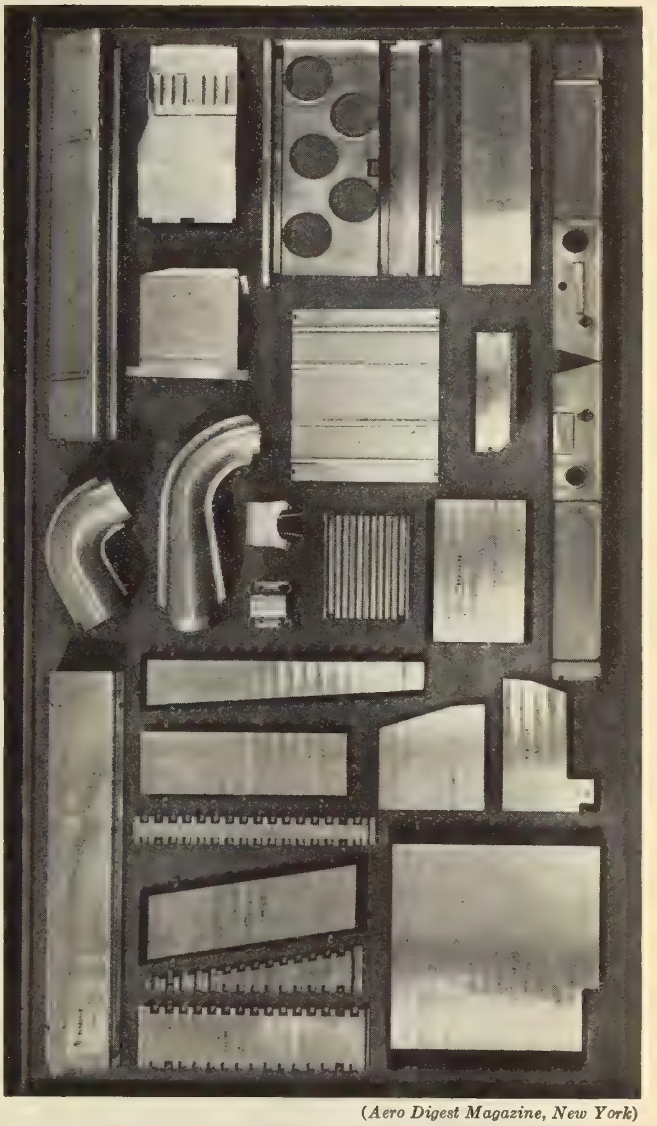
Although plastics are best known as moulded and extruded parts, this family of materials is also making notable contributions as water emulsions, corrosion-proof coatings, lacquers, enamels, adhesives, insulating materials, brake linings, fibre bonds, etc.

Adhesives

Since the outbreak of the war, the adhesive industry has had to meet the challenging call for new compounds, tailored to fit hitherto unfamiliar services. While the adhesive cost in any one assembly is usually but a small fraction of the cost of the finished product, its role, however, is of great importance since, should the compound fail, the whole article becomes valueless.

Adhesives have been developed which permit the bonding together of metals, wood, plastics, ceramic, fibres and rubber in any desired combination. Of these, perhaps, the most outstanding are Reanite, Mtlbond and Cycleweld. These adhesives are thermosetting plastics which are applied to the surfaces to be joined and then processed under heat and pressure.

The development of these adhesives, which are already being used in aircraft construction, has aroused considerable interest in industry. Continuous bonding of skins to underlying surfaces makes for smooth airplane surfaces, even distribution of stresses, ease and cheapness of assembly. The stiffness and strengths of assemblies having a continuous bond, have been shown to exceed riveted and spot welded assemblies.



(Aero Digest Magazine, New York)

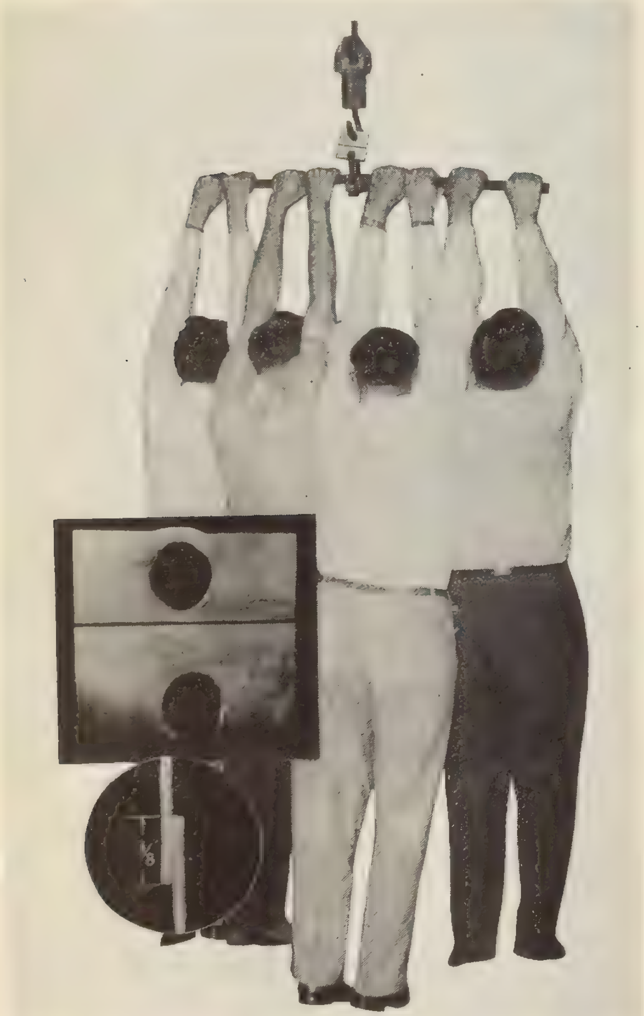
Several examples of successfully cyclewelded aeroplane parts.

These adhesives provide the strongest type of bond, i.e., a primary chemical bond between the metal or its oxide surface and the adhesive. In this type of bond, maximum adhesion is obtained with smooth polished surfaces. The shear strength of the joints is of the order of 3,000 lb. per sq. in. compared to about 1,800 lb. per sq. in. for the average riveted joint. The joints are satisfactory at temperatures of —70 to +250 deg. F.

The adhesive is prepared in liquid, paste and tape form and is applied to the surfaces by spraying, brushing, spreading or taping. Following this operation, it is made to cure under heat and pressure.

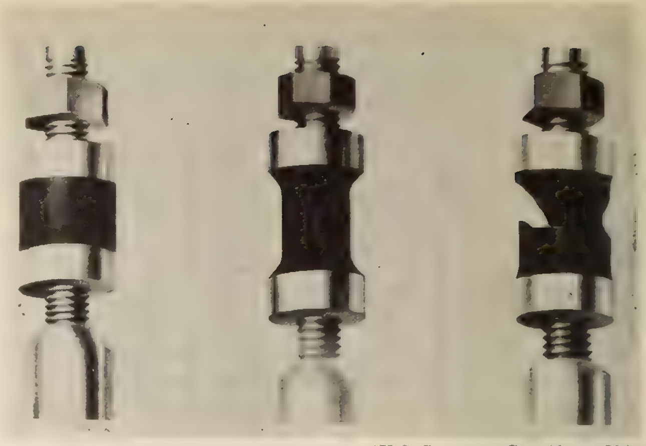
Illustrative of the uses to which these adhesives may be put, are bonding of Plexiglas to aluminum and the manufacture of an aluminum-fibreglass sandwich with one or more layers of aluminum. The latter material has a greater strength-weight ratio than aluminum alloys and when used as aircraft fuselage skin material, it offers the advantage of being a good sound absorbent, reducing drumming noise very materially.

Joining of materials with these adhesives has been thoroughly tested on aircraft parts, but its possibilities in other industries such as automobile and railroad are, as yet, untouched.



(U.S. Stoneware Co., Akron, Ohio)

710 pounds of weight were supported by this aluminum-to-aluminum Reanite bond. Bonded area measured 3 in. by ⅜ in. However, the metal itself was unable to stand the strain, breaking at the point shown.



(U.S. Stoneware Co., Akron, Ohio)

Tensile testing the Reanite bond (1) Disc of rubber cemented to steel plugs. (2) As pull is applied rubber elongates (3) At over 1000 lb. per square inch the rubber itself broke.

Fuels

Today, everyone is aware of the important role which liquid fuels have played in modern warfare. The drastic rationing of this commodity is easily understood when one considers the enormous quantities of gasoline which our air forces and mechanized war machines require. Petroleum technology has made great advances under the spur of our very pressing needs. These advances have had for effect a gradual improvement of the most important property of gasoline, i.e., its anti-knock characteristics. Today, gasolines with an octane rating of 130 and even 140 can be and is being produced in large quantities. The importance of this change can easily be appreciated when one considers that if two bombers were flying to a target 1,000 miles distant, the one using 100 octane fuel can carry 5,000 lb. more bombs than one burning 87 octane. This improvement can also be translated in increases in flight range, power, ceiling or, in the case of a fighter æroplane, greater agility during combat.

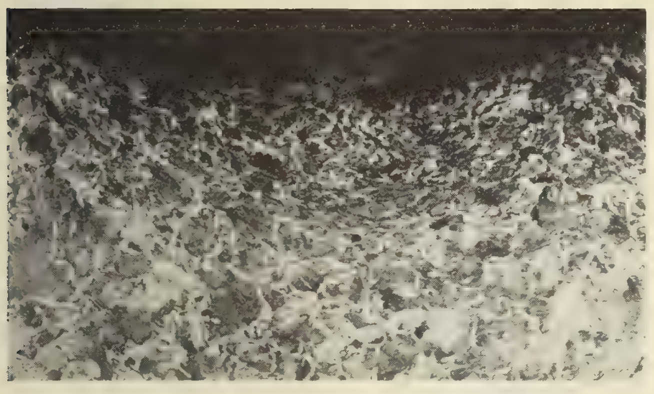
During September 1944, Mr. Charles F. Kettering, vice-president of General Motors Corporation, disclosed one of the most newsworthy developments in the field of liquid fuels. A process has just been developed which makes possible the manufacture of a new fuel having as much as four times the power obtained from present 100 octane gasoline. Of course, the details of this process are, of necessity, closely guarded. This new fuel, which is known as " triptane ", is now undergoing extensive testing and opinions have been expressed that, after the war, triptane may be manufactured at a cost of 50 cents to one dollar per gallon.

Shot-peening

Considerable attention has been given to the various methods of increasing the resistance of parts to fatigue. It is a well known fact to the designer that dynamically loaded parts cannot be designed on the physical properties obtained through the usual tension and other static tests. This is particularly true in the case of parts that are subjected to bending stresses in service. The designer must and does make allowance for the fatigue characteristics of the material. It has been established that fatigue failures result from tension stresses only, and never from compressive stresses. Thus, in members subjected to bending, fatigue failures always start on the tension side.

With this concept in mind, the attention of scientists has been turned towards methods of counteracting the high tension stresses at the outer fibres of parts loaded in service. By setting up compressive stresses in the surface layer of the work, the fatigue effect of tension stresses imposed by bending is reduced. This can be achieved in a number of ways, such as nitriding and shot-peening.

The latter process consists in pelting the surface of the work with round metallic shot at high velocity. Each shot acts as a tiny pee-hammer which makes a small indentation, causing the surface layers of the metal to flow. The result is that the entire surface is cold worked, leaving the worked layer in a highly compressed state. These residual compressive stresses off-set the tension stresses set up by loads during service and thus greatly increase the life of the part. The amount of surface cold working obtained depends on the size of the shot, the condition of the surface to be peened, the striking velocity, and the length of exposure to the rain of shot. The process should be carefully controlled, however, since it is possible to actually weaken the part by too long an exposure to the peening action.



(American Foundry Equipment Co.)
Photomicrograph of S.A.W. 1030 shot-peened steel-magnification 200 times.

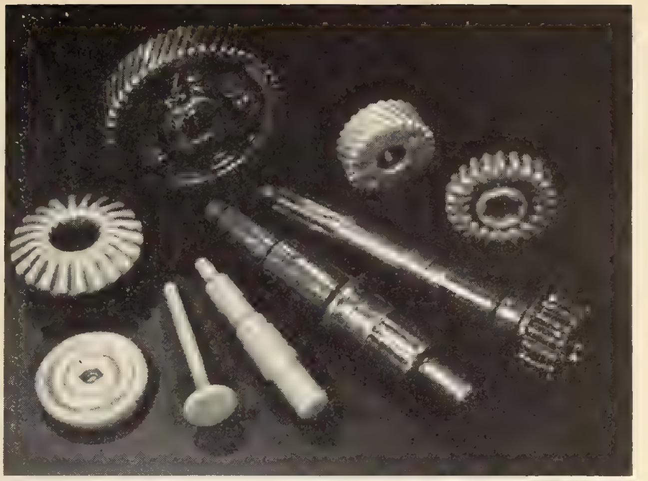
To illustrate the effect of shot-peening on parts subject to fatigue failures, we may mention the results of some tests which were made by the General Motors Corporation. The following increases in fatigue life were observed:

Welded joints	310%	life improvement
Steering knuckles	475%	" "
Helical springs	370%	" "
Engine crankshafts	900%	" "
Transmission main shafts	520%	" "
Hypoid gears	600%	" "
U-joint crosses	520%	" "

PROTECTION AGAINST CORROSION

A new method of protecting metal parts against corrosion during shipping or storage consists in dipping the parts in a molten plastic material made from ethyl cellulose. The part picks up a layer of the plastic which sets, on cooling, to form a tough waterproof coating. The plastic coating does not adhere to the parts and can be easily removed by slitting and stripping it from the part. The plastic envelope provides excellent protection from moisture and corrosive agents and also provides some mechanical protection.

Wartime shortages of tin and zinc have resulted in the wide acceptance of low-tin lead alloys as protective coatings for steel. Lead has been used extensively in the past for application where its resistance to atmospheric corrosion plays an important role. Illustrative of these are the lead roofs of the old European cathedrals, telephone line outer casings, etc. A few years ago, it was discovered that lead containing less than 3 per cent tin could be very satisfactorily applied to steel as a thin, strongly adherent coating which imparts excellent resistance to atmospheric corrosion. Shortages of terne plate and galvanized iron caused the attention of metallurgists to turn towards this coating alloy. The process consists in cleaning the parts to be coated by a blasting, pickling, or an electrochemical process, immersing the parts in a bath of molten flux, then in the coating alloy. These operations are followed by quenching in oil and, in the case of small parts, tumbling in a barrel filled with sawdust; this ensures a smooth uniform finish. Present applications of this coating process are muffler shells, foundry chaplets, automobile radiator shells, radio cases, condenser shells, etc. This metallic coating has been found so satisfactory that there is no doubt that it will find increased acceptance after the war when steel once more becomes available for non-essential uses.



(The Dow Chemical Company)
For protection against corrosion the parts shown above have been packaged in stripcoat and are ready for shipment.

Stripcoat has been slit and is about to be removed from shaft. Note cleanliness of machined surfaces and the exactness with which the coating has followed the contour of the part.

(The Dow Chemical Company)

X-Ray Inspection

Little will be said about the applications of X-rays in industry, since X-rays cannot be considered a recent development. Numerous improvements, however, have been made in X-ray apparatus. Automatic radiographic units and fluoroscopes have been developed making it possible to inspect as many as 4,000 parts per hour with tremendous savings in time and cost of inspection. Development of a 1,000,000 volt unit gives a new freedom to the applications of this method of inspection for heavy parts.

Heat Treatment

A newcomer in the field of heat-treatment is the application of induction heating in the hardening technique. The part to be heat-treated is heated by electrical currents induced by an adjacent coil through which is passed a high frequency alternating current. In this manner, the surface of the part becomes the secondary of a transformer. The depth of heating is controlled by the frequency while the speed of heating is a function of the power supplied. In this manner, the surface layer of the part to be heat-treated will come up to the heat-treating temperature in a matter of seconds. The quench is immediately applied and is closely followed by the draw.

Induction heating and hardening is essentially a surface hardening process and, as such, should be used in conjunction with shallow hardening steels, otherwise the heat-treated part will have a highly stressed surface. Induction-hardening closely resembles the flame hardening technique, in that it is applicable to localized zones, making it possible to harden certain areas of a given part without heating the whole piece, thereby eliminating distortion from this cause.

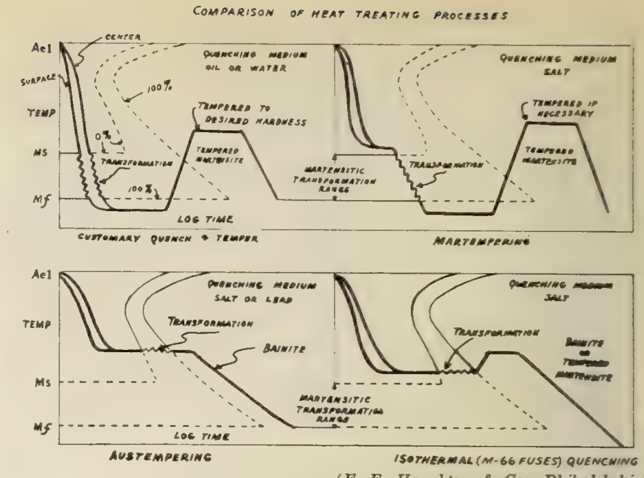
Induction heating is also finding wide acceptance as a localized heating medium for brazing and other applications.

Recent studies in isothermal transformation of steel have resulted in a much better understanding of the rationale of steel heat treatment. This new concept of heat treatment has resulted in new techniques known as "martempering", "austempering", etc.

In martempering, the procedure consists in quenching parts from the solution temperature into molten salt baths, at a temperature of 400-500 deg. F. This permits cooling of the steel fast enough to pass the knee of the S-curve untransformed and to bring it down uniformly to the temperature of the salt bath before transformation starts. The part is then cooled in air and hardens with a minimum of internal stresses and maximum of uniformity; this makes for more uniform properties in the heat-treated part and a minimum of distortion.

Austempering is an interrupted quench in which the austenitized steel is quenched in a molten salt bath, maintained at a temperature of approximately 600-800 deg. F. In this process, the steel transforms to bainite or intermediate structures. This process is used to obtain medium-high hardness combined with toughness and ductility.

Another form of "interrupted quenching" consists in quenching in a molten salt bath at 450 deg. F., holding at that temperature for a given length of time, then transferring the part to another bath heated to the draw temperature. This method permits heat treating heavy sections to a higher hardness than is possible with the conventional austempering method.



(*E. F. Houghton & Co., Philadelphia*)

Comparison of heat treating processes.

In general, it may be said that these various types of interrupted quenches were designed to reduce quench stresses, distortion and dimensional changes in the heat-treatment of steel parts.

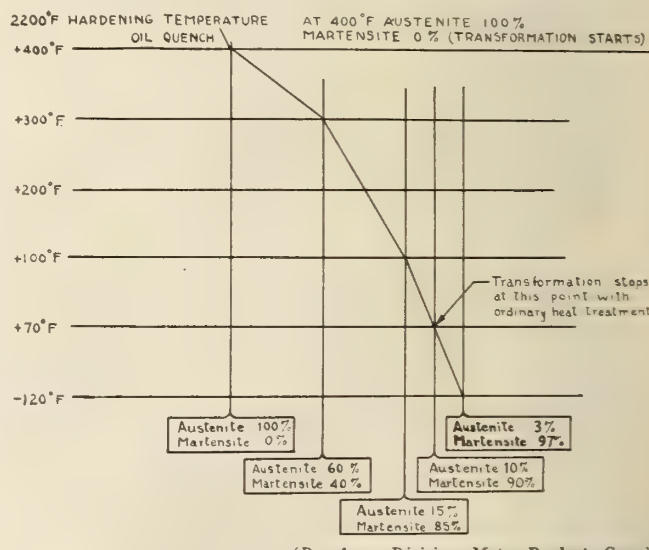
Cold Treatment

Cold treating is comparatively new but, while this process is still in its infancy, it has already proved of extreme value when used in the hardening, stabilizing, testing and shrinking of metals and other materials in a wide variety of industries.

Tests have shown that freezing of heat-treated steels to — 120 deg. F. will complete the austenite to martensite transformation and yield uniform hardness results. The temperature at which it is necessary to cold-treat a metal varies somewhat with the metal or alloy. In the case of steel, however, tests have shown that the austenite to martensite transformation stops at approximately — 150 deg. F.; little would therefore be gained by freezing to lower temperatures.

Cold treating has achieved remarkable results in improving the properties of heat-treated high speed steels, bearing steels, carbon steels, tungsten and nickel carburizing steels, magnet steels, etc.

When applied to high speed cutting tools, it has been found to increase the productive life of the tool

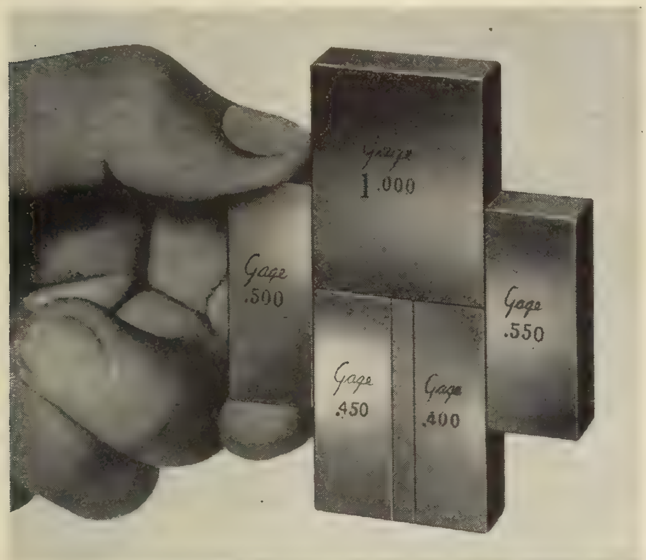


(*Deepfreeze Division, Motor Products Corp.*)

The above chart shows the curve of transformation of austenite to martensite in high speed steel at temperatures varying from 400 deg. F. to 120 deg. F.

considerably. The process consists in cooling the tools to — 110 deg. F. after the solution heat-treatment and prior to the tempering operation. Microscopic examination of steel subjected to this treatment reveals that an entirely different structure is obtained. Not only is the transformation of austenite more complete, but the martensite formed has a much finer appearance than that of steel not subjected to this treatment. The result of this treatment is that the cutting edge of the refrigerated tool does not chip as standard tools commonly do.

As much as 1000 per cent increase in tool life has been obtained through this process. Many manufacturers are using cold treating procedures to stabilize gauges, arbors, mandrels and other precision machine parts. Stabilization of cast iron lapping plates, aluminum castings, forgings and aircraft parts by this process is common today.



(Motor Products Corporation, Deepfreeze Division, Chicago)
Typical gauge blocks stabilized by cold treating to within .000002 in.

Other applications of cold treating, such as shrinking of parts for assembly, freezing of rubber for machining purposes will not be dealt with since these applications cannot be considered recent developments.

Metal Joining

Metal joining in recent years has gone through a remarkable period of improvement. To this rapid progress the low temperature silver brazing alloys have been important contributors. They have given industry a method of joining ferrous, non-ferrous and dissimilar metals at low temperatures, a method which is fast, reliable and an important factor in reducing manufacturing costs on a great variety of work. They have particularly speeded up and improved the joining of medium and light gauge metals and have made it economical to join modern alloys which are likely to be damaged by higher temperatures.

While brazing is not a new process by any means, some mention is made of it because of the importance which this method of joining materials has taken during the past few years. The brazing process has been brought to the fore mainly because brazing furnace operation has been recognized as an integral unit in manufacturing methods. In this process, the parts to be joined are fitted together and the brazing metal is applied to the joint in the form of wire or paste. The assembly is then passed through a controlled atmosphere furnace where the brazing metal melts and creeps into the joints by capillary action, forming a bond with the parent metal. As in the case of welding, the joint is often stronger than the parts. Application of brazing can effect savings in both cost and weight on certain applications.

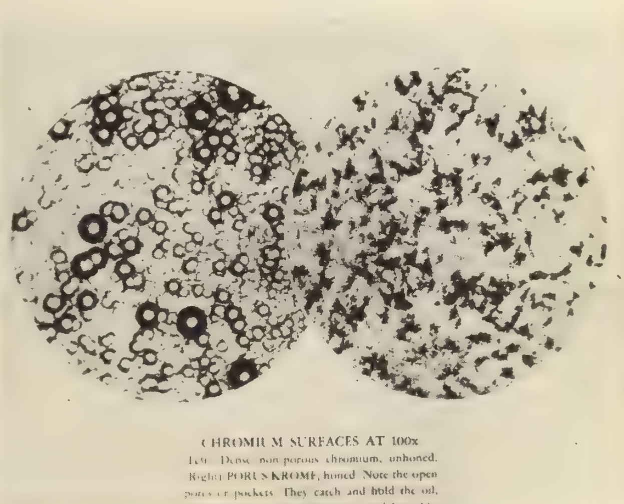
Electroplating

Perhaps the most notable recent development in the electroplating field is the large scale commercial application of porous chromium plating. The recent emphasis on this type of plating is directly attributable to the pressure of wartime demands. Porous chromium plating has been used to salvage hundreds of thousands of worn-out aircraft cylinders and also for treating new Diesel engine cylinders and piston rings. The ability of chromium to resist wear is now well known; ordinary chromium plating, however, is non-wetting, that is, oil runs off its surface without wetting it. Because of this characteristic of chromium, it cannot be used for bearing surfaces since it would not retain a film of lubricant. In order to overcome this characteristic of chromium, one solution is to produce a pitted plate which will retain oil in the cavities.

The porous chrome surface is made up of tiny " plateaux " of hard chromium surrounded by microscopic depressions or pockets which hold the lubricant. When produced by electrochemical methods, the chromium plate is deposited under carefully controlled conditions of both current density and temperature. The plate is then etched chemically or electrochemically to produce the required pits and crevices. The plate is then finished by either polishing, lapping or honing. It should be mentioned that the plating operation requires no special solution or equipment.

Approximately three years ago, a new hard chromium plating process was developed by Mr. Lundbye. This new technique of electroplating has been instrumental in obtaining remarkable performance of certain tools. Long term performance tests have shown that tools treated by this method will last an average of four times as long as duplicate untreated tools.

The Lundbye process differs from the conventional hard chrome plating in that the plate is extremely



CHROMIUM SURFACES AT 100x
Left: Dense non porous chromium, unhoned.
Right: PORUS-KROME, honed. Note the open pores or pockets. They catch and hold the oil, helping insure perfect lubrication and long life.

(Van der Horst Corporation of America, Cleveland, Ohio)
Photomicrograph of electroplated surfaces.

thin, usually of the order of 0.0001 in. and also in that it is not brittle. Treating tools by this method is not unlike ordinary hard chromium plating. The plating time, however, is only from 45 to 60 seconds and is followed by a one-hour heat treatment carried out in a high flash point oil at a temperature of 350 deg. F. Illustrative of the application of this process is the plating of forming, stamping and moulding dies.

DISCUSSION

J. F. Cunningham, m.e.i.c.[1]

Being the co-author of a paper* on the impact values of steels at low temperatures some time ago, and as this subject is not mentioned in the paper under discussion I would like to ask Mr. Lamoureux a question in connection with steels.

Our investigations showed fairly conclusively the existence of a definite brittle range in the neighbourhood of -20 to -25 deg. F. analogous to hot short range in steels.

Very little information was published up to that time and no work had been done with a close enough range to indicate such a brittle range. I note that since then many investigators have followed on cold temperature research.

The question I would like to ask is: "Has any action been taken to depress the apparent ' transition ' point below this critical temperature by heat treatment or the addition of alloys to steels subjected to low temperatures."

The expression transition point is used to define the distorted tension cleavage of crystals from the shear cleavage which may be the cause of a definite brittle point.

It was suggested that depressing this point to extreme low temperatures would be of benefit to steels subjected to shock stresses.

G. R. Black[2]

Mr. Lamoureux has given considerable emphasis under New Aluminum Alloys to the recently developed series of alloys containing zinc and magnesium as their main alloying constituents. In sheet form this is designated as 75S.

While the 75S series offers the highest physical properties of aluminum alloys and shows a rather striking increase over the conventional material Alclad 24S-T, the comparison with the copper-magnesium-manganese alloys that have been given a precipitation heat treatment is not as outstanding.

During the past few years, there has been a never-ending demand for higher and higher mechanical properties in aluminum alloys. As a result, the alloy Alclad 23S replaced the original 17S in England shortly before the war began, while in the United States the use of Alclad 24S was extended until it became universal. Having reached this point, further increases were obtained in the United States by the introduction of precipitation heat treatments, now known as the Alclad 24S-T 80 series. In England, the trend has also been to double heat treatment, but here the material used is Alclad 26ST, an old forging and extrusion alloy turned into use as an Alclad alloy.

When the guaranteed values of these alloys are considered, Alclad 75ST offers only an increase of some 10 per cent on ultimate and yield strength over Alclad 24S-T 81 and 15 per cent over Alclad 26ST.

All of these alloys involve similar heat treatments consisting essentially of a solution heat treatment of about 500 deg. C, the exact range varying with each alloy, followed by a low temperature precipitation heat treatment to develop the full properties.

At the present time, the formability of Alclad 75S can be stated only in general terms. In the annealed temper the higher yield strength as compared to Alclad 24S-O must be taken into account in some operations. In rubber-pad hydraulic press work, higher pressures may be required on some parts. In general, only minor changes should be necessary in adapting tools designed for Alclad 24S-O, although present indications point to the need of slightly larger radii.

In the " W " or " as quenched " temper the room temperature age-hardening characteristics of Alclad 75S should prove an advantage; compared to " as quenched " Alclad 24S age-hardening proceeds at about one-half the rate, increasing considerably the time interval of good formability. In the " T " or fully heat treated temper, however, Alclad 75ST is less workable than Alclad 24S-T sheet. Bend radii will have to be increased and dimpling for flush riveting requires some changes from current practice.

In conclusion I would like to compliment Mr. Lamoureux on this paper which has, in a very concise and yet detailed manner, presented so many new developments in aircraft materials and processes.

D. Hiscocks[3]

The following discussion deals with the portion of the paper devoted to wood and metal adhesives.

Many of the phenol formaldehyde resins provide an excellent wood adhesive, but I question whether these resins should receive all the credit for the development of a durable plywood, for the melamine and resorcinal formaldehyde adhesives are redoubtable competitors of the phenolics, and the melamine modified ureas also produce an excellent bond. In assembly work, low temperature setting phenols, melamines and resorcinals are in general use and are vastly superior to the low temperature setting ureas when the emphasis is placed on durability.

Concerning adhesives generally, I consider Mr. Lamoureux's choice of outstanding materials open to challenge, for we have tested in the laboratory at the National Research Council at least half a dozen other well-known adhesives which are markedly superior in certain important respects to some of the materials mentioned.

Some care is necessary in comparing the strength of a bonded joint with that of an " average riveted joint " because form factors play so important a part. For example, distortions in a riveted joint will often redistribute the loads and produce a more uniform stress in the various elements, whilst similar distortions in a bonded joint may produce forces normal to the plane of the adhesive and precipitate a complete failure at very moderate average shear stresses.

*"Impact Values of Rail Steels at Low Temperatures," J. F. Cunningham and J. Gilchrist, Trans. Amer. Soc. of Metals, 1932, May.

[1]Senior Inspector of Dredges, Department of Public Works of Canada, Selkirk, Man.

[2]Aluminum Company of Canada, Limited, Toronto.

[3]Head, Structures Section, National Research Council, Ottawa.

It should also be emphasized that these metal-to-metal adhesives are in the experimental stage from the standpoint of composition and technique in application. Since service experience is meagre and almost entirely confined to lightly stressed components, there is an absence of data to permit the design of efficient bonded joints. A great deal more structural experience will be necessary with these materials before the design of highly stressed joints can be undertaken with confidence.

R. D. Speas[4]

Mr. Lamoureux's review of materials and processes brings to mind a recent lesson we have had in selection of aircraft materials. It has been found that, so far, no one material will efficiently meet the requirements of all aircraft. I am referring to the so-called "all steel" and "all wood" which have been designed, and in some instance actually constructed. Under comprehensive tests they have been found wanting and subsequently discarded because of basic deficiencies which were realized because of the excessive use of the one material to the detriment of weight or structural efficiencies. The demands of aircraft design do not revolve about one material only and Mr. Lamoureux has very wisely given a broad paper covering many materials of direct use in the aircraft industry.

J. Waller[5]

On page 379 the author states in regard to the new high strength aluminum alloy, "This alloy can be torch, arc, spot and seam welded, riveted, dimpled, anodized and painted like any other strong aluminum alloy." Our comments to this are that, as far as we know, no high strength wrought aluminum alloy is approved for torch or arc welding. Any information that he can give us on this subject will be very useful. Also, should the author have any information on the dimpling of this alloy, this too, would be very useful to us.

Under the heading 'Shot Peening,' the author states: "It has been established that fatigue failures result from tension stresses only, and never from compression stresses." Exception should be taken to this statement on the basis of a paper by Professor H. F. Moore of the Univerity of Illinois, entitled, 'Shot Peening and the Fatigue of Metals.'" Professor Moore states: "When the cross section of a beam is of such a shape that the compression stress is 50 per cent or more greater than the tensile stress, fatigue failure may start and slowly progress as a shear crack on the compression side of the beam. A T-beam with the flange in tension is an example of this."

Under the subject of 'Heat Treatment', it might be interesting to state that induction heating, and hardening impairs the fatigue strength of steel due to the differential expansion, and contraction of the cross-section of the part. This has been established by J. O. Almen of General Motors in a recent article in *Metal Progress*.

Apart from the above, the paper gives an excellent general review of recent developments on the subject.

The Author

Answering Mr. J. F. Cunningham's question regarding the properties of steels at low temperatures, I would like to point out that in this paper I have mentioned the low temperature treatment of steel as a means of improving its mechanical properties.

No mention was made of the properties of steels when at low temperatures. The cold treatment merely completes the decomposition of austenite, resulting in improved mechanical properties.

A good deal of information regarding the behaviour of metals at low temperatures has been obtained in recent years and it has been established that not all metals and alloys become brittle under such conditions. In general, when metals are subjected to low temperatures, the hardness along with the tensile and yield strengths increase. The toughness, however, as evidenced by elongation, reduction of area and impact strength, does not necessarily decrease, in fact, some metals maintain their toughness at low temperatures while others even show an improvement in this property in spite of their increase in tensile strength. Low alloy ferritic or pearlitic steels generally have very low impact values at low temperatures. Additions of certain alloying elements such as copper or nickel, however, lower the temperature at which these steels show marked decrease in toughness. It should be noted, however, that toughness at low temperatures does not depend entirely on composition since internal stresses and microstructure also play an important role. In general, low internal stresses and good structural homgeneiety make for less change of toughness with lowering of temperature. For this reason, austenitic steels or those with uniform structures like homogeneous sorbite are tougher than those with mixed structures, e.g. pearlite—ferrite.

Mr. G. R. Black's comments are very welcome and to the point. I would like to point out, however, that the 24S-T8 series of aluminum alloys were purposely omitted from this paper for the following reasons. While it is true that the artificially aged 24S alloy offers properties which can, through adequate cold working prior to artificial aging, approach the properties of 75ST alloy when taken individually, the overall picture is certainly in favour of the new 75S alloy.

The improvement in the mechanical properties which can be achieved with 24S alloy through the combination of artificial aging and cold work is done at the expense of elongation, which introduces a serious problem from the designers' standpoint. If we compare the various tempers of 24S we find that 75ST provides as good elongation as 24S-T 80 while the tensile and yield strengths of the former are vastly superior to those of the latter. In fact 24S-T 80 is inferior in all respects to the standard 24S-RT. The use of the T81, T84 tempers do not offer the high mechanical properties of 75ST while their elongation are considerably lower with a consequent decrease in formability. The properties of the T86 temper leave very little to the designer or the man in the shop from a formability standpoint. The small difference between the yield and ultimate strength values almost prohibits the use of 24S in this temper, especially in aircraft applications where the margin of safety provided by the gap between initial deformation and failure of a material, is of vital importance.

If it is true that 75ST requires special dimpling and forming techniques, how much more must this be true when working with 24S-T86! The manufacture of 24S-T 81 etc. . . . introduces an additional cold working operation which is not required in the case of 75S-T. Furthermore, the artificial aging of 24S ex-

[4]Assistant to the Vice-President in charge of Engineering, American Airlines, Inc., New York.

[5]Materials and Processes Engineer, Fairchild Aircraft, Limited, Longueuil, Que.

trusions is not generally beneficial except for very thin sections.

I believe that while the recent developments in the artificial aging of 24S with various degrees of cold work is of great interest from an academic standpoint, the advantages from a practical standpoint are not very great in view of the fact that the 75S type of alloy has been developed. As more experience with the working of 75S is gained and suitable tools are developed, I feel that the trend will be towards a more extensive use of 75S-T, a much smaller part being played by 24S-T and 24S-RT. As for the 24S-T80, T81 and T86, I am of the opinion that they will completely disappear except in the odd case where fabricating practices and end uses will minimize the disadvantages associated with the use of 24S in these tempers.

I must confess that my knowledge of adhesives is very limited. Dr. Hiscocks' comments on adhesives are very interesting and certainly make a very worthwhile contribution to this paper.

To my knowledge, the phenol formaldehyde adhesives have played a major part in the development of a durable plywood and continue to be used very extensively throughout the wood working industry. They do not require extreme care in avoiding thick glue lines and they meet every requirement of an ideal bonding material except that they require either very long setting times at room temperature or the necessity of a high temperature cure to reduce the setting time. Recent developments in methods of applying heat and pressure certainly have gone a long way towards minimizing this disadvantage.

Modifications of this type of adhesive such as the resorcin base resins permit the use of lower curing temperatures. I do not wish to imply, however, that the phenol formaldehyde adhesives should be given all the credit for developments in plywoods. As mentioned in the paper, the ureas have made great contributions in the last few years. Dr. Hiscocks has brought out the fact that the melamine modified ureas also give excellent bonds, having better moisture resistance than the cold setting ureas. These melamine modified ureas, however, are inferior to the phenolic resins in a number of respects.

Regarding Dr. Hiscocks' question as to my choice of outstanding materials, I have selected what seemed to me to be adhesives which have proved their value in extensive industrial application. A case in point is the Cycleweld process developed by the Chrysler Corporation and used extensively throughout the United States. Many important sub-assemblies, such as wing flaps, stabilizers, etc., use this process in their fabrication. All tests so far have shown this to be a versatile technique which is certain to have an increasing number of applications not only in the aircraft field but in other industries which will not fail to realize the advantages to be derived by this new method of joining materials.

The point regarding certain precautions to be observed when comparing riveted and glued joints is well taken by Dr. Hiscocks. I did not imply that gluing will ever entirely replace riveting as a method of joining metals. I feel, however, that the development of these glues will find a great number of applications where heretofore standard joining processes lacked in some important respects. The fact that these glues also permit the easy joining of dissimilar materials in almost any combination gives industry at large a new tool with which to improve existing products and to create new ones.

Mr. Speas's remarks are very much appreciated inasmuch as they stress a point which unfortunately was not adequately emphasized in the paper.

The choice of materials for aircraft as well as for other applications is not based entirely on the strength and weight properties of the materials. While these values are often of paramount importance from a design standpoint, their importance is tempered by other considerations, such as corrosion resistance, ease of fabrication, necessity of applying finishes, appearance, methods of joining, cost and availability, and a number of other factors which all contribute their share in determining the suitability of the material for a given application.

The material chosen must have a combination of properties which, when weighed against cost, make it eminently suitable for the proposed end use. When one considers that a material which is suitable for structural purposes because of high strength and other properties is not necessarily the ideal material for decorative fittings where the strength of the material is unimportant, it is easy to realize that the "all steel" or "all wood" aircraft to which Mr. Speas refers cannot be either economical or efficient.

The discussion contributed by Mr. Waller is sincerely appreciated. Characteristically, several important questions have been asked and pertinent points emphasized. In answer and for elaboration, the following remarks are offered:

Mr. Waller states that to his knowledge "no high strength wrought aluminum alloy is approved for torch or arc welding", i.e., for fusion welding. While it is true that fusion welding of strong wrought aluminum alloys is not recommended for applications where the strength of the joint is of importance, these alloys can, nevertheless, be satisfactorily fusion welded for non-structural purposes. Metallurgical consideration of the heat treatable alloys shows that fusion welding cannot give joints equal to the unwelded portion of the structure. This is clearly shown by the figures given in the following table:

Condition	*0.1% Proof Stress Tons/Sq. In.*	*Ultimate Tensile Strength Tons/Sq. In.*	*% Elongation on 2 In.*
Chill Cast	9.2	10.7	1.0
Chill Cast and Heat Treated	13.2	18.4	1.8
Wrought and Heat Treated	15.0	26.5	18.0
Wrought and Annealed	6.0	17.0	17.8

Taken from an article by Dr. E. C. West in *Metallurgia*, April, '43.

It should be noted that the properties of cast Dural after heat treatment and aging compare badly with the wrought material. In the article, I merely indicated that the 75S alloy can be fusion welded, not necessarily for structural purposes and that in this respect it is not inferior to other strong wrought aluminum alloys. As far as dimpling sheets of this alloy is concerned, this can be done very successfully if the proper tools are used. The spinning dimpling tools manufactured by Topflight Tool Co., are said to give very satisfactory results. In order to obtain good results it is necessary to have smooth edges on the hole, free from scratches or nicks.

Mr. Waller's remarks on fatigue failures, quoting Professor H. F. Moore's statement that such failures can occur as a result of compression stresses, goes unchallenged. I feel that these remarks make a valuable contribution to the paper in correcting a faulty statement. The remarks regarding heat treatment are also very welcome.

"OPERATION PLUTO": THE STORY OF THE CHANNEL PIPELINE

From August 12, 1944, to May 8, 1945, about 120,000,000 gallons of gasoline reached the Anglo-American Armies in Europe via the pipeline system laid under the English Channel by British engineers in co-operation with the British Navy. One million gallons daily still reach France by way of 20 undersea pipelines. Sixteen of these run from Dungeness, on the southeast coast of England, to Boulogne and four from the Isle of Wight to Cherbourg, and are thence carried via high pressure gasoline lines to the Rhine. This vast engineering feat was called "Operation Pluto", meaning "Pipeline Under the Ocean", and guaranteed uninterrupted delivery of bulk petroleum, usually needing a special harbour and dock and extensive storage facilities, across the beaches, making it invulnerable from air, surface or submarine attack, and completely independent of the weather.

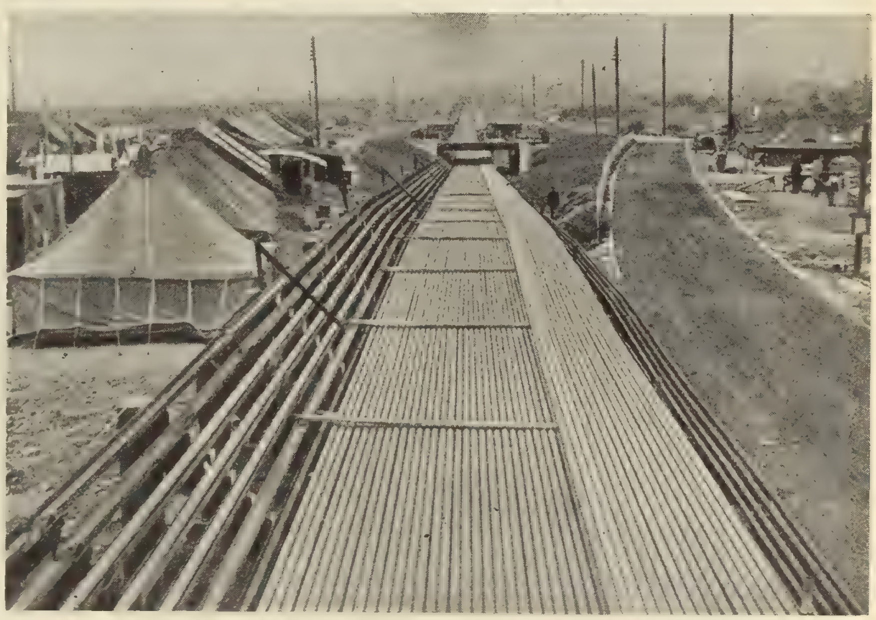
While the British Pluto project was under way, the United States Army was working on a similar idea. After discussions between the respective authorities, it was agreed that efforts should be concentrated on Pluto, and United States authorities magnanimously co-operated fully in many directions. General Eisenhower and his chief officers took an active interest in Pluto's development, and a unit of the United States Army Engineers Corps, under the direction of Colonel A. K. Easton, New York, arranged for the manufacture of 140 miles of HAIS cable by the General Cable Company, Phelps Dodge Copper Products Corp., the General Electric Company and the Okonite Callender Cable Company. With the exception of the 140 miles of cable manufactured in the United States, the Channel pipeline was a purely British operation in plan and execution.

It was Lord Louis Mountbatten, then head of Combined Operations, who in April, 1942, asked Geoffrey Lloyd, British Minister of Petroleum Warfare, if an oil pipeline could be laid across the English Channel. The experts were doubtful, but A. C. Hartley, Chief Engineer of the Anglo-Iranian Oil Company, who had used three-inch high-pressure pipelines in Persia, suggested a pipeline something like a submarine electric power cable without cores and insulation, which could be laid across the Channel in a few hours from cable-laying ships.

By working day and night over two week-ends, technicians of the firm of Siemens and Henleys completed the full-scale order for several hundreds of yards of this pipeline to be laid in the Thames from a cable-ship loaned by the British Post Office. The results were so successful that Prime Minister Churchill gave the scheme his blessing and two 30-mile lengths of cable were ordered to the original two-inch diameter, so that full-scale trials could be held in Bristol Channel, where the currents and other conditions approximated most closely to those found in the English Channel. Subsequently, the cable diameters were increased to three inches and strengthened for working pressures in excess of 1,200 lb. per sq. in. Eight months after Hartley's idea originated, when half a gale was blowing in Bristol Channel, the experimental cable was laid by *H.M.S. Holdfast*, originally a coaster which had been fitted with gear for transporting this unusually heavy cable, and gasoline was delivered from Swansea to Ilfracombe. The fact that the cable was hollow increased the difficulties, since it was liable to kink and so stop the oil flow. The cables were therefore laid full of water, which kept them inflated. This pipeline was called the HAIS (Hartley-Anglo-Iranian-Siemens).

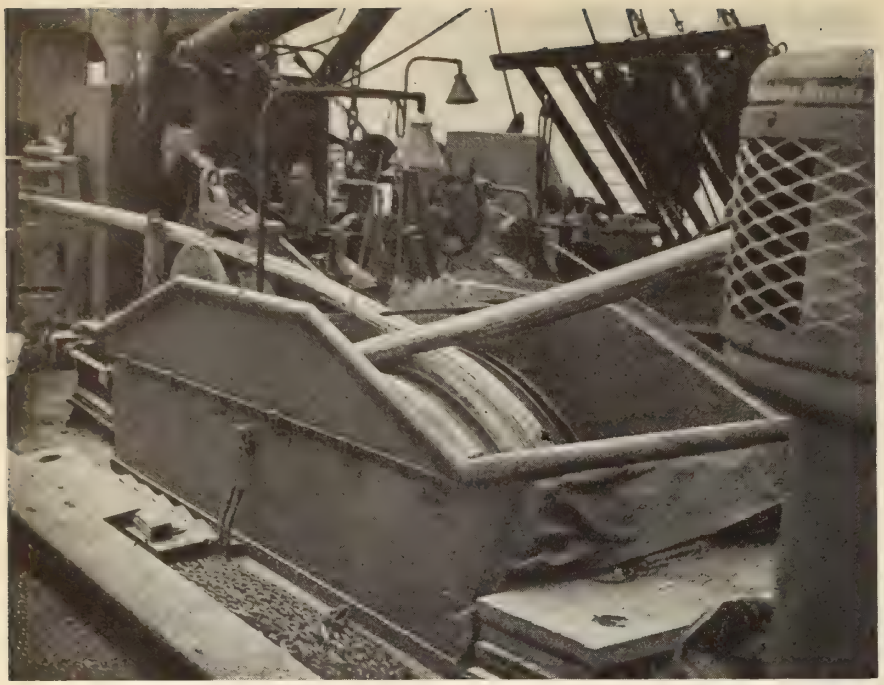
Meanwhile another pipeline was invented by B. J. Ellis, Chief Oilfields Engineer of the Burma Oil Company, and H. A. Hammick, Chief Engineer of the Iraq Petroleum Company. This second pipeline, named "Hamel", was composed of 20-ft. lengths of three-inch diameter steel pipe which could be welded automatically into any length and could be wound on to a drum like thread on a spool, if the drum were 30 or more ft. in diameter. To use this, the Admiralty's Director of Naval Construction designed *H.M.S. Persephone*, converted from a hopper barge to a craft with a great wheel rotating in trunnions on her deck and capable of carrying many miles of the three-inch Hamel pipe and paying it into the sea. From this a second idea was developed—a floating drum capable of carrying the full length of pipe which might be required for the Channel crossing, and which could be towed by tugs like a large bobbin paying off the pipe as it went.

Within a few months, a special factory at Tilbury, in the Thames Estuary, was equipped for welding 20-ft. lengths of the Hamel pipe into 4,000-ft. lengths at a rate of 10 miles daily, with facilities for storing the lengths to a total of 350 miles a day. Shortly afterwards,



(*British Official Photograph*)

Hamel pipe stored in three-quarter-mile lengths for winding on the Conundrums, the huge seagoing "bobbins" which laid the pipelines by rolling it off as they were towed across the Channel. About 200 miles of pipe can be seen in this picture.



(British Official Photograph)

The 3-inch HAIS cable passing round the cable drum of the Liberty ship *Latimer* during the laying operation. This shows the flexibility of this continuous-built pipe.

a duplicate factory was established in case the first should be bombed.

The floating drums, called *H.M.S. Conundrums* (or "Conuns" for short) were moored in deep water at the end of the pipe-racks, so that the 4,000-ft. lengths might be welded into a continuous length of 30 or more miles, and wound on to the Conuns while they rotated. A Conun is 90 ft. long, over 50 ft. in diameter overall, and when fully wound weighs 1,600 tons—the weight of a destroyer. It can carry 70 miles of pipeline. The drum around which the pipe is wound is 40 ft. in diameter and 60 ft. long.

After the successful trials of the HAIS cable in April 1943, Geoffrey Lloyd arranged that the manufacture of HAIS cable and Hamel pipe, and the coordination of the whole scheme, together with provision of pumping stations on the English shore, should be the responsibility of Britain's Petroleum Warfare Department. The work then developed in conjunction with the Admiralty Department of Miscellaneous Weapons Development, while the Royal Navy accepted the responsibility of laying the pipes at sea. Thus Force Pluto was formed under Captain J. F. Hutchings of the Royal Navy, composed of ships of all sizes from 10,000 tonners down to barges and motorboats manned by British Merchant Navy seamen. The Force was placed under the command of Admiral Sir Bertram Ramsey, Allied Naval Commander.

Force Pluto's main base was Southampton, England, with a secondary base at Tilbury. The Force numbered 100 British Merchant Navy officers and 1,000 men. In addition to *H.M.S. Holdfast,* three merchantmen were fitted with the cable-laying machinery. Two could carry 100 miles, and one 30 miles of HAIS cable. Thames barges were converted for handling the cable at the shore ends, where large ships could not operate. Six Conuns handled the Hamel pipe. New pipelines were run from the British system to take the gasoline to the coast, and special high pressure pumping stations were cleverly camouflaged. One of these was in a row of blitzed houses at Sandown, on the Isle of Wight; another was in an old fort built in the 1860's against possible invasion by Napoleon III; and others were in a modern amusement park and in seaside villas at Dungeness.

"Operation Pluto" began as soon as the mines had been swept to the approaches to the tip of Cherbourg Peninsula. The lines running from the Isle of Wight to Cherbourg took 10 hours to lay and conveyed gasoline to the United States armies. The lines established as soon as Boulogne was captured, from Dungeness to Boulogne, took five hours to lay and transported gasoline to the British 21st Army Group. Men of the Royal Army Service Corps pumped oil to cleverly concealed pumping stations on the French coast, frequently in rough weather, having to wade up to their necks to bring in the end of the line from the ships. An R.A.S.C. petroleum unit also maintains direct contact with the Trench terminals by cross-Channel wireless-telephone, thereby instantly detecting and reporting variations in the quantities delivered.

Paying tribute to this British engineering feat, Prime Minister Churchill said: "A large part of the Allied Expeditionary Force has been supplied with petrol by this unique method, which provides for petroleum the same kind of facilities upon a hostile shore that the Mulberry (prefabricated) harbours provided for general military stores. Operation Pluto is a wholly British achievement and a feat of amphibious engineering skill of which we may well be proud."

General Dwight D. Eisenhower expressed his "warm appreciation of the work the Pluto pipelines have done in supplying United States as well as British forces in their drive into Germany."

(British Official Photograph)

Gasoline pipe line running over marshy land in Europe as it carries fuel to the front lines.

From Month to Month

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

A REPORT TO THE MEMBERSHIP FROM THE COMMITTEE ON PROFESSIONAL INTERESTS

The following report is made by the Committee on Professional Interests so that each member may have a sufficient knowledge of the facts to appreciate the present situation. The committee believes that its action has been in the best interest of the profession, and trusts that a study of the details will lead the members to the same conclusion.

At the May meeting of Council a quite important decision was reached on an item of business that has been before the Institute for over eight months. It had to do with a specific proposal to establish a cooperative council to represent a large group of organizations both professional and technical.

The proposal in its final form was presented to the " Committee of Fourteen " toward the conclusion of a collective bargaining session of that committee at Ottawa in October, 1944. Its adoption was moved and seconded by representatives of the Canadian Institute of Mining and Metallurgy. The proposal was similar in most details to one that had been prepared previously by the Dominion Council; and presented at the previous meeting of the " Committee of Fourteen ". At that meeting after an exhaustive discussion during which strong opposition to it was expressed by several organizations, it was withdrawn by the Dominion Council representative without being submitted to a vote.

As four of those who had so strongly opposed the earlier proposal were not at the October meeting, the Institute requested that no vote be taken but was overruled, the re-worded proposal being approved with only the Institute failing to support it.

The subject was reported to Council at the October meeting in Edmonton and after a full discussion was referred to the Committee on Professional Interests for study and a report. The committee met several times with members coming long distances to attend. It consulted all past-presidents, vice-presidents and councillors. It referred the subject to the provincial professional associations with which the Institute had agreements with a request for an expression of opinion.

This exhaustive study was made because the committee appreciated the importance of the subject, and was determined to reach no conclusions except those based on actual facts and reason. Out of its own deliberations, and out of the opinions expressed by others it prepared a " Statement of Principles and Policy of the Institute on Relations with Sister Societies ", which subsequently was approved by all the officers and organizations consulted, and most recently by the Council of the Institute. It appears on page 400 of this issue in the Minutes of Council for the May meeting.

At the same meeting of Council a second report of the committee was accepted. This recommended that the Institute " do not participate in the new council ", but that instead it support a proposal made by The Corporation of Professional Engineers of Quebec for the establishment of a presidents' conference committee that would consider matters of common interest without establishing a new organization with a permanent secretariat and assessments against member organizations. This is in close agreement with the proposal made in clause E of the Statement of Principles of the committee.

It has been a difficult duty for the committee to recommend against the new engineer's council. The Institute has always taken such a leading part in cooperative projects that it is not easy to decline the invitation to join with so many good friends who are active in the new organization, but it appears clear to the committee members and to others who have been consulted, that the present proposal will be unnecessarily expensive without accomplishing the desired objectives. The committee believes it is better to face the situation now, openly and frankly, than to temporize with matters of such vital importance.

As a matter of fact the Institute is not in a position to join such a council as at least four of the provincial associations with which it has agreements have expressed themselves with unmistakable emphasis as opposed to it. Each association has studied the proposal in considerable detail, before reaching a decision.

It may be interesting and profitable to examine the principal consideration which led the committee to its recommendation with regard to the new council.

1. The experience of engineering societies in Canada and the United States, shows that attempts to operate similar organizations have resulted in failure, frequently doing injury to the cause of cooperation.

2. It is felt that it is not wise or fair to ask non-engineering organizations to unite with engineering bodies, unless the engineering bodies can first coordinate their own thinking and activities. The committee suggests, therefore, that endeavours towards establishing cooperation should be confined to engineering societies before extending the field to non-engineering groups (the new council includes architects, chemists, science workers, foresters, etc.).

3. There are already too many engineering and technical organizations in Canada. An additional one is likely to add confusion to an already confused situation, without producing sufficiently beneficial results.

4. The new council regulations provide that each society has one vote and that a two-thirds majority is all that is required to establish and control any issue. This could mean that six small organizations could outvote the three larger ones. This might result in matters of importance to engineers being defeated by others whose interests were not identical with those of engineering bodies.

5. The costs of operation are to be assessed on a membership basis, so that the present proposal, which appears inadequate to meet even the initial expenses, would cost the Institute over $700.00 a year. The committee believes that the Institute should not have to pay a portion of the cost of operation for smaller organizations, particularly when the majority are not strictly engineering organizations.

6. The only example of a successful cooperative society of which the committee is aware is the Engineers' Council for Professional Development (E.C.P.D.) of which the Institute is the only Canadian member,

but there are substantial differences in the terms of reference between E.C.P.D. and the new council. One factor which has had a great influence on the success of the E.C.P.D. is the organizational setup. The chairmanship is circulated among the member societies, and the secretaryship (without remuneration) follows a definite plan of rotation on an annual basis. This has greatly reduced the cost of operation, and has removed every possibility of any one organization dominating the council.

There are also these differences—

(a) E.C.P.D. membership is limited strictly to engineering bodies. (b) No action can be taken unless decisions are unanimous. (c) E.C.P.D. is largely a fact-finding and study group that passes on its recommendations to the constituent members. When authorized to act by them, it does so with dispatch and general acceptance.

By and with the consent of all its constituent members, the E.C.P.D. has, through its sub-committees, undertaken the following very important endeavours:

1. The inspection and rating of engineering colleges throughout the United States.
2. The preparation of a uniform code of ethics.
3. The preparation of a declaration of principles, such as " The Faith of the Engineer ".
4. Guidance to young men who wish advice regarding entering the engineering profession.
5. Guidance to the young graduate, particularly with respect to self-education along cultural lines.
6. The development of a professional consciousness.

7. The committee believes that the basis upon which the new council is formed is not clear. Some of the objectives as described in the literature seem to be visionary and impractical and other clauses are vague or contradictory. The committee thinks it will be injurious to cooperation to launch an organization and a programme unless they have been thought out clearly and fully in advance. It is certain to lead to serious differences of opinion and possibly to disunity.

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 cooperation whenever it will react to the benefit of the profession or the public. Cooperative projects will find the Institute always ready to carry its share of the burden, and to work closely with its sister societies.

MONTHLY REPORT ON REHABILITATION

In the first monthly report on rehabilitation which appeared in the May number of the *Journal* an analysis of the completed questionnaires was presented. The number of questionnaires that have been received has increased from two hundred and twenty-four at the end of April to three hundred and seventy-five at the end of May. However, the proportions of the groups as they were classified last month have not changed very much as demonstrated by the following figures:

	April 30	*May 31*
Number of questionnaires received....	224	375
(1) Those who require no assistance	78	120
(2) (a) Those who have pre-war positions to return to, but will probably seek new positions	57	85
(b) Those who have graduated since the beginning of the war and have immediately entered the services, or temporary war work followed by enlistment, and will therefore seek new positions....	36	64
(c) Those interested in further education (not included in above)	53	106
Total	146	255

From these figures it is seen that the requests for information or assistance comprise about two-thirds of the total and that more than one-third of the total will require new positions after demobilization.

A general indication of the kind of employment being sought by these men is given by the university background:

37% graduated in civil engineering
24% graduated in mechanical engineering
27% graduated in electrical engineering

The remaining 12% is made up about equally of mining, metallurgy, chemical and physics.

Policy and Action Taken

From this analysis it has been possible for the Committee on Rehabilitation to decide the best general ways in which to serve the needs of the members in the armed forces.

I. There is evidently a very real need for advice concerning the continued education of members of the Institute as demonstrated by the figures in paragraph 2 (c) of the analysis of their requirements. Therefore, a comprehensive paper has been written, including the pertinent information on the facilities available under the Post-Discharge Reestablishment Order and containing sound advice based on the opinion of several prominent engineer-employers, and on the Office Manual for this Order, of the Department of Veterans Affairs. This paper is now being printed and will be sent to all those interested. It will also include a list of names of members of the Institute in all parts of Canada who are willing to act as advisers.

II. The questionnaires indicate a strong desire for information on present employment conditions with which service men are now unfamiliar, and for the establishment of pre-discharge contacts. To fill this need, the employment page of the *Journal* has been considerably amplified, as will be seen in this issue, to give as broad a picture as possible, and to provide a source of contacts. This will naturally be read by all who receive the *Journal* but there are many overseas men who do not, so the page is being printed separately and will be sent by first class mail to all such members who are interested. Employers are urged to make this service as comprehensive as possible by submitting all their present or estimated vacancies.

III. It was suggested, at the last meeting of the Committee, that one of the most important functions the Committee could perform would be to give employers some idea of the value of the training and experience received in the armed forces. For this purpose an article is being prepared to emphasize the fact that engineers in the armed forces have received training and education that could not have been obtained in any other way, and which in general makes them very much more valuable employees and citizens.

HONOURS FOR THE PRESIDENT

Members of the Institute everywhere will be pleased to know that at the convocation on May 30th, McGill University conferred on Dean E. P. Fetherstonhaugh the honorary degree of Doctor of Science.

McGill's list of graduates contains the names of many outstanding Canadians, who have applied their learning to the advancement of Canada. Some have become famous in many parts of the world, others are household names here at home. Usually teaching does not bring fame or glory, but it is doubtful if any calling contributes more to the welfare of a country. It is gratifying therefore to see an outstanding teacher so fittingly recognized by his *alma mater*.

For over 35 years Dean Fetherstonhaugh has taught engineering at the University of Manitoba. Quietly and intelligently he has applied himself to his task, and year after year he has sent out into the world groups of young men who were not only well grounded in mathematics and science, but who were prepared also for good citizenship because of the personality of the man who planned and controlled their destinies for four formative years.

Manitoba graduates everywhere will rejoice at McGill's recognition of a great teacher and a great man. Engineers from other institutions will join with them gladly, for Dean Fetherstonhaugh is well and favourably known far beyond the boundaries of the province of his adoption.

President Fetherstonhaugh is presented with an honorary Doctor of Science degree by McGill University. He is shown above with Morris W. Wilson, chancellor of McGill.

The citation follows:

Mr. Chancellor: I have the honour to present to you, in order that you may confer on him the degree of Doctor of Science, honoris causa, Edward Phillips Fetherstonhaugh, Professor of Electrical Engineering and Dean of the Faculty of Engineering and Architecture at the University of Manitoba, and president of The Engineering Institute of Canada.

Mr. Fetherstonhaugh graduated with honours from McGill in 1899, and this early promise has been fully borne out in his distinguished career as a consulting engineer whose clients included many of the cities and the provincial governments of Manitoba and Saskatchewan, as well as the federal government of Canada.

After two years teaching at McGill, he moved to Winnipeg and was selected to organize the department of electrical engineering at the University of Manitoba in 1909, and he has been professor and head of that department since that time. From 1921 he has been Dean of Engineering and Architecture at the same university with outstanding success.

During the first great war Mr. Fetherstonhaugh served with the Canadian Engineers in France and Belgium, where his services were recognized by the award of the Military Cross in 1916 and Mention in Despatches in 1918. He rose from lieutenant to major, and later was promoted to lieutenant-colonel when he served five years as O.C. of the Officers Training Corps at the university.

A group of past-presidents entertained Dr. Fetherstonhaugh at dinner on Convocation Day. From left to right: Past-President A. Surveyer, J. B. Stirling, Past-President G. H. Duggan, Dr. Fetherstonhaugh, Past-President de Gaspé Beaubien, Past-President J. M. R. Fairbairn. In the foreground, F. S. Keith and P. E. Poitras.

Despite his active life as a consultant, a teacher, and an administrator, Mr. Fetherstonhaugh has found time for duties to his community and his country. He served as a trustee of the Winnipeg General Hospital; on the Advisory Board of the Royal Military College; as chairman of the Winnipeg Electrolysis Board; and for the last eight years he has been a member of The National Research Council of Canada. His long continued interest in The Engineering Institute of Canada culminated in his election as president for the current year.

Mr. Chancellor, it is a personal pleasure to present this quiet, unassuming man who has accomplished much in the interest of his country and to whom his *Alma Mater* now wishes to do honour—Dean Fetherstonhaugh.

THE DISPOSITION OF THIS YEAR'S GRADUATING CLASS

Considerable interest has been shown in the disposition of this year's graduating class in engineering. In this connection some comparisons covering the past three years might be helpful. As indicated by the registration figures, published in the *Journal* each winter, the total number of graduates in all Canadian universities has been slightly under 800 in each of the three years 1943, 1944 and 1945. In the allocation of such graduates, the technical needs of the Armed Forces have naturally been given first priority and the approximate numbers absorbed under this heading (either immediately on graduation or shortly afterwards) have been 400, 300, and 175 in the three years respectively.

In addition to the numbers accepted for technical commissions, there were in 1943 and 1944 an additional 40 to 50 in each year who enlisted in the ranks of one of the three services. These were all men who had sought technical appointments but could not be accepted largely because the number of suitable candidates substantially exceeded the number of openings. As they wished to see active service, they therefore sought and obtained permission under the Science Student's Regulations for their enlistment.

For the class of 1945, the number of openings for technical appointments is considerably smaller than it has been in any previous year since the war broke out; but at the same time there existed, when plans for the use of this class were being formulated, a definite need for infantry reinforcement officers. In view of this need, the graduating students were informed that an opportunity existed for those who were not able to secure technical appointments to enter training as infantry officer candidates. It was felt that such openings would appeal particularly to those who had been unsuccessful in securing technical appointments but were, nevertheless, anxious to see service. There will, therefore, be a certain number of this year's graduating class who will enter the infantry reinforcement stream as potential officer material.

At the present time, there is naturally some question in the minds of both the prospective candidates and of others interested as to the chances for anyone, entering the Army at this date, of seeing active service. About all that can be said in this regard is that the business of disposing of Japan is and will be a stern task in the absence of any definite knowledge as to what resources the Japanese still have to draw on both in the way of material and morale. One man's guess as to the length of the job is as good as another's, but it is not likely to be shortened by overlooking the need for adequate preparation. One essential feature of this preparation is the provision of adequate reserves of trained officers for the future.

The number of new graduates available for civilian employment will in any case be greater this year than it has been in the past and, during the coming months, the rate of which trained engineers will become available through demobilization will undoubtedly be stepped up. Therefore, employers who are interested in rebuilding their engineering staffs can now give some thought to their requirements for the first time since war broke out.

WASHINGTON LETTER

E. R. Jacobsen, M.E.I.C.

"On a Note of Triumph" is the title of Norman Corwin's new and widely acclaimed book. This significant title appeared on the newsstands the day after V-E Day was finally "ratified" on May 8th. Well, one is tempted to review the events of the last month on a note of triumph, but the very magnitude of these events, the immensity of the problems, and the remaining Pacific War all tend to stay the hand and restrain enthusiasm. V-E Day in Washington was like every other day. There was no jubilation, no demonstration and little pause. Work went on as usual. Some of us brought radios to the office to hear Churchill and Truman and, later in the day, the King. But in the main, Washington took immediate heed of the President's sober statement and acted on his assertion that the watchword must be "work, work and more work." Then, too, official Washington is keenly aware of the problems and difficulties yet to be overcome — of the grim race ahead in which there is real danger that the "Four Horsemen may outride the Four Freedoms," to use Clare Luce's telling phrase.

Of course, Washington was still in mourning for the dead President. It has been a deep and real mourning, commensurate with the wide and lasting imprint of his personality on this Capital city and on the people, big and little, who work here. Following the service at the White House, W.L.B. Chairman Taylor said with deep emotion that he felt just as though he had lost his own father. Then, too, I believe Washington instinctively realized that the day belonged to London. Coming out of five years of black-out, and with over five grim years of struggle and suffering behind, London and the rest of England had every reason to relax and celebrate for a day or two before turning to the Pacific.

The Historic Week

However, just for the record, there was one particular week or ten days in the last month which will go down in history. This was the week during which progressive millions of Germans surrendered in Italy, in the West, on the Eastern front, and in Norway and Denmark. It was a week in which the fears of stubbornly-held pockets resistance was obliterated. Finally all of Germany collapsed and the Nazi régime, built to last a thousand years and which came nearer in succeeding at world conquest than any other attempt in history, went down in ignominious defeat, drowned in its own blood and buried in its own ruins — its leaders quarrelling and turning on each other in subterranean shelters far below the wreckage and desolation of Berlin and the bomb-scarred pavements of the Wilhelmstrasse. This week saw the death of two dictators — Mussolini and Hitler. There were the false rumors of peace and then, finally, the surrender at

Reims and another surrender ceremony to the Russians at Berlin. Over-shadowed by the world-shaking events in Europe, the war in the East also made great strides during this epic period. One of the most significant events was the capture of the port of Rangoon and the speed with which the capture was effected. In sharp contrast to the slow and bloody fighting round Mandalay, Jap resistance at Rangoon quickly collapsed and the city and port were taken almost intact.

General Review

A more general review of the events of the last month would have both debit and credit entries. In spite of stormy weather, it is still expected that the San Francisco Conference will at least lay the groundwork for a security organization. The extension of the Trade Agreements Act has passed its first hurdles. Controversy still rages round the Bretton Woods and the Dumbarton Oaks proposals. General Marshall's point system for demobilization has been presented to the nation in an excellent movie entitled " Two Down and One to Go " and has been very well received. Director of War Mobilization and Reconversion Vinson presented his report " The War — Phase II " with admirable promptitude a day or so after V-E Day. The report is a sober analysis of the situation and makes recommendations for the vigorous prosecution of the Pacific War and for cautious and carefully considered reconversion to some peacetime production. Judge Rosenman warns that the responsibility for the relief of destitute Europe will fall largely on the United States and that such calls will constitute a " must ". The Colmer Committee on Postwar Economic Policy and Planning has issued an excellent report on "America's Place in International Trade ".

From a military point of view, things look better in China. The Chinese may well take a new lease on life and Mr. Donald Nelson reports that the Chinese War Production Board is fulfilling all expectations. He told me that he regards this experiment as the first step in the industrialization of China. Good news from China, however, is offset by the increasing seriousness of inflation and the continuing Communist-Kuomintang deadlock. In the interests of world security, it is most important that some solution be found to this situation and that the outside world does not take sides. It is to be hoped that President Truman can follow Roosevelt's policy which looked to the reaching of a compromise solution within China between Chungking and Yenan.

Returning to Europe, we find at the time of writing that Marshal Tito's argument over Trieste is still unsettled. The various aspects of the Polish problem still give concern. Clear-cut policies are yet to be laid down with respect to the punishment of war criminals and a coordinated plan for the occupation of Germany yet remains to be worked out. The work of the Reparations Committee is also awaiting overall policy decisions.

Have Come a Long Way

Lest the picture looks too sombre or the job ahead too difficult, it is well to look back and see how far we have already come and against what odds our present complete military victory in Europe has been won. When war was declared on September 3, 1939, we faced the most superb war machine ever created. Poland was over-run in a few days. Russia, who at that time had a non-aggression pact with Germany, marched into the Eastern part of Poland and later on in November invaded Finland. In April of 1940, Germany occupied Denmark and Norway and then launched a general offensive on May 10 in the Low Countries and in a matter of days swept through Holland and Belgium and into France. The rescue from the beaches of Dunkirk retrieved all that was left of the British Expeditionary Force. On June 10, Italy entered the war, on the 13th the Germans marched into Paris, and on the 22nd, the French Government signed an armistice. In August and September the Battle of Britain was won. This was the first real glimmer of hope followed by the successful British drive in December into Libya. In March 1941, Bulgaria joined the Axis, and on March 11, the United States passed the Lend-Lease Act. In April, Germany invaded Yugoslavia and Greece. On June 22, Germany invaded Russia. The next months saw a steady chain of successes for the Axis Powers and the eventual entry into the war by Japan on December 7. Then came the battles of Midway and the Coral Sea. The next main milestone was on November 2 of 1942, when the British Eighth Army shattered Rommel's line at El Alamein. It was this victory that prevented the great panzer move between the Germans and the Japs which was to meet in India and isolate Russia. On November 8, the Allied Armies under General Eisenhower landed in North Africa. Another milestone was the successful defence of Stalingrad in late 1942.

We have indeed come a long way since the dark days of 1940 and the early months of 1941. It was early in 1941 that the Lend-Lease Act was so bitterly debated and all sorts of amendments, including one to exclude Russia, were suggested. Nazi domination of Europe was viewed as inevitable in many quarters. It was early in 1941 that Sir Edward Peacock and Hanbury-Williams came to this country " to get rid of British holdings in America ". The question at issue was whether there was yet time to save England. It was in this period that Virginio Gayda could threaten the United States. These were the days when Dover was known as " Hell's Corner ". Colonel Lindberg, in testifying before the Senate Foreign Relations Committee, said that he did not believe that England was in a position to win the war and favoured a negotiated peace. Also early in 1941, helpful signs began to appear. The Lend-Lease Act gained increasing support in influential circles. Winant went to London. Wendell Willkie visited England. E. R. Stettinius, Jr. moved into the Office of Production Management. Donald M. Nelson became the Director of Purchases in the Office of Production Management. Leon Henderson became head of price stabilization. Mackenzie King announced that Canada was virtually doubling her overseas forces.

From mid-1942 on, the issue has not been greatly in doubt. The fighting has been long and bitter but the end came on a rising crescendo of successes. Encouraged by the colossal effort and sacrifice which have already been expended, and bearing in mind the great obstacles already overcome as a result of united action and combined planning, we should go forward with confidence in the difficult tasks of beating Japan and of reconstructing Europe and, eventually, of building a system of world security.

E. R. Jacobsen, m.e.i.c.

Washington, D.C., May 23rd, 1945.

TECHNICAL SERVICE CONTROL HAS DONE A GOOD JOB

H. G. Cochrane, M.E.I.C.

The following article was written at the request of the *Journal*. The Engineering Institute, as one of the three sponsors of the Wartime Bureau of Technical Personnel, has been remiss in not keeping the members informed in sufficient detail of the work and purpose of the Bureau. This article, and others to follow, is an attempt to present something of the interesting story that stands back of the colossal task so well accomplished by the Bureau.

Mr. Cochrane's kindness in preparing these articles is greatly appreciated.—*Ed.*

Canadians don't like regimentation and controls. We are all prone to criticize governmental agencies, particularly when the regulations they issue affect us individually. None of the controls set up for the more efficient prosecution of the war are immune from some criticism. Even the Wartime Bureau of Technical Personnel has come in for its share, though broadly speaking the engineering profession has appreciated being allowed to apply its own controls through an organization of its own sponsorship.

But much of such criticism as has occurred from both employers and employees, directed against the Bureau over recent months, has been undeserved and unfair. It seems in large measure to stem from a misunderstanding of the functions of the Bureau and its primary objectives.

Restrictive controls and production priorities have been a necessary part of governmental policy in strengthening the war effort. The Wartime Industries Control Board and the various controllers, the Prices Board and Selective Service, are responsible for these controls and priorities. The Bureau is only governed by them, and merely interprets them insofar as they affect the cases it has to deal with.

Sponsored by the engineers and scientists of Canada, it was set up by Order-in-Council in March 1942, some six months in advance of general manpower regulations under National Selective Service. It operates under the Minister of Labour, with an Advisory Board composed of representatives from the Canadian Institute of Chemistry, The Engineering Institute of Canada, the Canadian Institute of Mining and Metallurgy, the Provincial Associations of Professional Engineers, the National Conference of Canadian Universities, and the Canadian Manufacturers' Association.

The Order-in-Council under which the Bureau functions does not compel the individual to accept employment, but it does limit his choice of employment, since he cannot work without a permit and the permit will not be issued except for high priority work!

The Bureau also acts in an advisory capacity, not only to those firms and departments who need the services of engineers or scientists, but also to the many thousands of individuals who want to know how they could best serve in the national interest.

The first and all-important objectives of the Bureau have been to aid the war effort and to minimize labour turnover at technical levels. In this respect they have done a splendid job. They have registered and classified some 36,000 technical persons, as well as some further 17,000 technicians not falling within the category of engineers or scientists. They have been solely instrumental in placing about 1,000 a year or a total of around 3,500 technical personnel in the Armed Services or in war production. They have issued close to 13,000 permits for technical employment. They have assisted in allocating more than 5,000 new university graduates to the Services and to positions in industry, and have directed some 14,000 students to summer employment in essential service.

But the Bureau was never intended primarily as an employment service. Its first duty was to channel technical services into the war effort. The tasks of fulfilling the needs of individual industries, and of placing engineers and scientists in suitable positions, at fair rates of remuneration, were entirely secondary; and in this respect it is only fair to say that in the majority of cases, they have performed a very creditable and satisfactory job for both firms and individuals.

Through the foresight of some of the leading scientists and members of the profession, and by the good fortune of having a sympathetic hearing in 1941 from the then Deputy Minister of Labour, Dr. Bryce Stewart, the application of manpower controls to technical personnel fell into the hands of engineers themselves. Had it not happened this way, upwards of thirty thousand scientists and technicians would have been handled along with all other groups of employees at Selective Service offices.

But instead of such a procedure, the scientist or engineer corresponds with or is interviewed by a technically trained executive of the Bureau who has immediate access to the central file containing his complete record, or, he may find it more convenient to interview one of the regional representatives of the Bureau at Vancouver, Winnipeg, Toronto, Montreal, Quebec or Halifax. At these centres, enquiries are constantly coming in from firms and departments, and if they can't be satisfactorily matched locally with men with suitable qualifications, they are circulated through Ottawa headquarters to other centres. Here the engineer or scientist is assured of a sympathetic humanized interview with someone who talks his own language, who is posted on the general picture of employment in the engineering field, and who knows the answers.

The Bureau has had a tough assignment. It has carried it out well. Its job is not over. There are between five and six thousand technical persons serving in a technical capacity in Canada's Armed Forces, not including a further 3,000 to 4,000 in non-technical branches. More than half of them are wartime university graduates. Add the thousands of placements in war industry now doing temporary wartime work, and you have a measure of the task ahead in re-allocation. This adds up, according to estimates made by the Bureau, to some thirteen thousand technical persons who have to be resettled in permanent positions during the periods of demobilization and reconversion. Much of the task must be dovetailed with gradual relaxation of controls until Japan is conquered. More of it is concerned with getting these scientists and engineers back into peacetime jobs, of finding suitable peacetime employment for these thousands of young scientific graduates who never before held a peacetime job. The Bureau needs our continuing sympathy, co-operation and support.

THE SONS OF MARTHA AND THE MODERN CHALLENGE

Rudyard Kipling's immortal poem "The Sons of Martha" has been taken by engineers especially, as a portrayal of the obligation which rests upon them. At the risk of seeming presumptuous the following verses are given, in the hope that they will cause some persons to pause and reflect upon the deeper significance of current events; for acceptance of a labour code is an acquiescence to the principle of the right to strike. The keynote of the obligation is "You may not fail them".

THE CHALLENGE

For nineteen hundred years since then,
The Sons of Martha have played their part,
Believing freely that duty called them
To practise in truth their wondrous Art
In simple service, unfailingly given,
Leading Mankind to a fuller life,
Hoping they'd use it to live together
Away from the pain of war and strife.

The law of the Lord and the laws of men
Who shall compose them, world without end,
Can it be true that we've found the answer
When to our parliaments, men we send?
Have we accomplished what was forbidden
And can we now do just what we like?
Is the ban removed by which we're ridden
So the Sons of Martha may go on strike.

Is this the watchword for which we waited
Order-in-Council One Thousand and Three?
So now at last we're emancipated
For the laws of men have made us free.
The sense of duty no longer shall hold us;
We join our brother the labour man;
Fight for our rights and nothing shall keep us
From getting the best for ourselves we can.

The Sons of Mary must be more careful,
They shall know fear when the path is dark
That will arouse them to give us justice
So we'll keep them safe when they embark.
They can not leave it to Sons of Martha
To save them from fire and broken dyke;
They must be ready to meet their Maker
The Sons of Martha may be on strike.

But once we were proud to be Engineers,
Part of a world professional clan.
Shall we accept it, this modern status,
Putting our ethics under a ban?
Can we be free of the fatal stigma,
Reaping the whirlwind that man has sowed?
Is there escape from this dark enigma
Once we are under a labour code ?

Saint John, N.B. C. C. Kirby, M.E.I.C.

COMMUNITY PLANNERS WANTED

The Institute has received in recent months several inquiries as to persons competent to advise on community planning.

Headquarters would appreciate hearing from members: 1. Who have a general interest in the subject and are available for promotional work in their municipalities. 2. Who are available for professional assignments. 3. Who are interested in working on a local or national committee.

COOPERATION IN QUEBEC

Time limit extended

The councils of the Corporation of Professional Engineers of Quebec and of the Institute have arranged an extension of the time limit for the privileges of the cooperative agreement. So many members of each organization have asked for an extension that, at the latest meetings of both governing bodies, unanimous approval was given to the committee's proposal.

The privileges of the agreement that were available to existing members of either organization, ordinarily would have expired on April 21st. Under the new arrangement these are extended to the end of the year. It is expected that this will increase greatly the number who are able to take advantage of them. It is almost impossible to cover the situation thoroughly in the ninety days that were allowed in the agreement. In all fairness to each organization this additional time is necessary.

Separate notices of this ruling will go to all Institute members in Quebec who have not yet made application for membership in the Corporation, but this notice in the *Journal* will also inform them of the extension and may prompt them to act immediately.

FARM ELECTRIFICATION

Discussion by E. V. Caton, M.E.I.C.
Chief Engineer and Manager of Production, Winnipeg Electric Co. Winnipeg, Man.

The following discussion was presented at the Annual Meeting of the Institute in Winnipeg last February, and was inadvertently omitted from the printed record which appeared in the April issue of the *Journal*. We offer our apologies to Mr. Caton and to our readers.—Ed.

The first reading of Mr. Tomlinson's paper would almost give one the idea that long spans, high tensile strength conductors and use of iron wire for conductors were a recent development by the proponents of rural electrification, and that one of the causes of the slowness in the extension of farm electrification was due largely to the persistence of the older engineers in using, for rural lines, the type of construction common in cities where short spans, heavy construction and large factors of safety are used. Actually, of course, long spans, wire pulled up to high stresses and the use of iron wire in rural work has been practised for many years. As far back as 1920, spans of 500 ft. and more were used by utilities for farm work. However, the demand for farm electrification was small and the utilities were so busy on urban extensions that it was only with the demand for farm electrification that these long spans have come to the front.

On the problem of economics, the suggestion that annual revenues in the past have been called upon "to pay six per cent interest, to provide a sinking fund to pay off the debt in twenty years, and to establish a depreciation reserve to assure that, at the end of twenty years, the system will still be as good as new," is a condition which is seldom if ever found in privately owned utilities. The provision of both sinking fund and full depreciation reserve from earnings is, I believe, prohibited by most utility commissions, and sinking fund is not an expense chargeable to operation under the Dominion Revenue Act. Even in the case of publicly owned utilities where tax exemption is the practice, I question whether it is usual.

Mr. Tomlinson is to be congratulated in bringing before the profession the necessity for economy in construction and for keeping costs down to a minimum if farm electrification is to be made possible. Obviously, long spans with their resulting high stresses in conductors are a means to this end. It should not be forgotten, however, that what is needed is a balanced design and that low first costs do not necessarily mean low total costs. It is comparatively easy to figure the construction costs but by no means so easy to figure what the maintenance and operating costs will be, and unless the proper consideration of all factors going towards the total costs of farm electrification are kept in mind, it is quite possible that a saving in capital costs may result in an increase in maintenance and operation costs which will more than eliminate any capital savings. Sometimes, in discussing farm electrification and in reading the voluminous literature now available on this subject, one cannot help feeling that all the stress is on first costs and not sufficient consideration is given to total costs.

Just how far one can go in span length and conductor tensions without resulting in high maintenance costs often due to overloading structures, caused by high unbalanced stresses of broken wires, is something that will have to be found out by experience. There is one thing that must be kept in mind in all designs of farm lines and that is, if rural electrification is to be successful, the standard of service will have to equal that of city service. The farmer will not continue to buy expensive equipment such as milking machines, feed choppers, etc., unless he can be assured of good service, and it is essential that such equipment should be sold on the farms if the consumption is to be brought up to a point where even with subsidizing by tax exemption, low interest rates and even direct contributions, electrification of farms will be possible.

Mr. Tomlinson's remarks on grounding are interesting but not conclusive. It is, of course, obvious that the resistance of the ground return is low compared to the resistance of the return wire. However, the return wire does fix a potential gradient between the delivery and supply points and if adequately grounded along its length should provide a reasonable and safe distribution system. The use of the ground only as the return, as suggested, is something which would have to be carefully analyzed and which would require considerable experience before one can definitely express an opinion. As to its safety, I do not think that the fact that no trouble has been experienced on approximately 1,000 miles of such lines is conclusive. The variation in ground conditions is excellently dealt with in the paper and most interesting.

Mr. Tomlinson's suggestion of careful consideration of modification of the wiring in the farm house and buildings is very much to the point. The main features brought out by him are vital for safety and should give reasonably inexpensive wiring of farm buildings, and I agree with him that some modification of the present type of wiring as installed in the ordinary urban home is necessary.

I was glad to note his remarks in connection with standardization. The cost of equipment can undoubtedly be materially reduced if standardization resulting in mass production can be obtained. This has been proved conclusively on the R. E. A. work in the United States. However, so far in Canada, the only accepted standards seem to have been those of the particular utilities making their own standard, but judging from Mr. Tomlinson's remarks, there is hope in the near future of considerable improvement in this particular field. In standardizing, however, one should be careful not to shut the door to technical advances.

As to the economy of farm electrification, Mr. Kelly's paper was particularly interesting. However, I personally feel that it is a confirmation of the oft expressed opinion that farm electrification is something which cannot be considered purely from a dollar and cents point of view. In the cases he quotes, even the lowest rate with a consumption of over 100 kwh. per month results in a net rate per kwh. of over 6c and at this high rate the service will not carry itself. I do not believe that the farmer is going to be satisfied unless he secures a rate comparable with the rates now prevalent in publicly owned city areas.

Farm electrification is something which should be considered more for its social implications; just as we do not expect good roads, schools, rural telephones, etc. to pay monetary returns, but support and subsidize them so as to make life on the farm more pleasant, so rural electrification should be considered as a means of raising the standard of farm life somewhat nearer to that of the city. When we consider that over 40 per cent of Canada's population is rural, it is obvious that we cannot have a satisfied country unless the standard of living of this 40 per cent is somewhere comparable to that of urban residents. Following the war, unquestionably there will be a large return to the farm, and the problem will be to make farm life sufficiently attractive to encourage movement from the towns to the country, reversing the existing trend. On the basis of this argument, I think we should look facts in the face and realize that farm electrification is coming, that it will have to be bonused or subsidized and that just how much privately owned power utilities can afford to bonus this social betterment scheme is something which their own management will have to decide. One thing we can be assured of is that if privately owned utilities do not provide farm electrification, then the government will step in and provide same.

MEETING OF COUNCIL

A meeting of the Council of the Institute was held at Headquarters on Saturday, May 19th, 1945, convening 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, P. E. Gagnon, J. A. Lalonde, E. Lavigne, C. C. Lindsay, C. A. Peachey, P. E. Poitras, and W. L. Saunders; Treasurer R. E. Chadwick; J. B. Stirling, chairman of the Committee on Professional Interests; Secretary Emeritus R. J. Durley, General Secretary L. Austin Wright, and Assistant General Secretary Louis Trudel.

Rehabilitation of Members in the Armed Forces: The general secretary presented a letter from the secretary of the Ottawa Branch which described a discussion which had taken place at a meeting of the management committee of the branch relative to the Institute's inauguration of a rehabilitation service. The committee suggested that Council review the situation, particularly as it appeared that government agencies doing rehabilitation work would seem to be serving the same field. The committee thought it was dangerous to have too many organizations working towards the same end.

Mr. Saunders, councillor of the Ottawa branch, stated that at the meeting referred to in the letter there was no unanimity of opinion and that the committee did not express itself definitely as opposed to the undertaking. They only asked that it be given further consideration. He, personally, was of the opinion that a rehabilitation officer could do much more for the membership than merely obtaining positions for the returned members.

The general secretary reported that when he and Major MacCallum were in Ottawa on May 10th they had called on Mr. Marr, the chairman of the branch and had explained the situation to him, stating, at the same time, that they would be glad to meet with the executive of the Ottawa Branch at any time so that the full story could be placed before them. Mr. Marr approved the suggestion and promised to inform the general secretary of a convenient date.

Wartime Bureau of Technical Personnel: Mr. Poitras asked why the director of the Wartime Bureau of Technical Personnel had opposed the Institute establishing a rehabilitation service. He inquired as to the necessity of continuing the Wartime Bureau after the war. It appeared to him that the Department of Labour was arranging to supersede the Bureau by establishing an executive and technical personnel division in the employment offices of the department. He thought that an attempt should be made to keep such a service out of the employment offices.

The general secretary, as the Institute's representative on the Advisory Board of the Bureau, reported that the future of the Bureau had been discussed quite frequently and that recommendations had been made to the Minister that the service be continued after the war but without any of its compulsory powers. At the last conference with the Minister he had explained that he could not make any final decision until after the election, but that he could assure the Advisory Board of the Bureau that no decisions on policy involving the Bureau would be taken without first consulting the Board. He pointed out that there had been definite signs that the officials of the employment service division of the Department were in favour of taking over the technical personnel work as well as all other branches of employment. Not long ago the Department authorized the opening of executive and technical personnel divisions in several offices but up to the present time it had been put in force only in the Montreal office. They had been unable to secure any properly qualified technical personnel to operate these offices at the salaries offered, and accordingly the positions had been filled by non-technical persons drawn from other departments of the employment offices. It did not appear that any technical personnel were using this new office.

Mr. Wright reported that in Great Britain the Department of Labour had made a study of the post-war employment services and a committee under the chairmanship of Lord Hankey had rendered a very complete report which recommended strongly that the employment of professional personnel should be handled by professional personnel and it recommended appropriations for carrying out this work that were staggering as compared to the appropriations made available in Canada. Many parts of the Hankey report have already been implemented and he was of the opinion that it would be a very backward step and out of accord with the recommendations of all properly experienced and qualified persons, to turn the employment of such persons into the hands of improperly qualified staff.

Dr. Gagnon, who also is a member of the Advisory Board of the Bureau, emphasized the possible importance of the Minister's statement that there would be no changes in policy without first consulting the Advisory Board. He recommended that Council now pass a resolution which could be placed in the hands of the Institute's representative on the Board, expressing appreciation of the Minister's decision and also emphasizing and reaffirming its previous decision that the Bureau should be continued after the war as an employment service for professional personnel.

Finally, at the request of Council, the following resolution was prepared which, on the motion of Mr. Lindsay, seconded by Dr. Gagnon, was approved unanimously:

> The Council of The Engineering Institute of Canada is pleased to learn that the Minister of Labour has informed the Advisory Board of the Wartime Bureau of Technical Personnel that no change in Bureau policy will be made by the Department without first consulting the Advisory Board.
>
> Council wishes also to reaffirm its earlier recommendation that the Bureau be continued without restrictive powers for a reasonable period after the cessation of hostilities so that technical and professional personnel may have an employment service appropriate to their requirements.

Committee on Professional Interests: Mr. J. B. Stirling, chairman of the Committee on Professional Interests, after reviewing the history of the committee's work on the subject of a new co-operative organization, presented a short report in which the committee recommended that the Engineering Institute "do not participate in the new organization".

Mr. Lindsay moved the adoption of the committee's report but at the same time stated that he was of the opinion that there was a need for an organization such as he had suggested last year—a Presidents' Committee. He thought that such a committee would meet whatever needs there were for joint co-operation and, at the same time, its existence would prevent the recurrence of proposals for another co-operative organization such as that which had been brought forward at a meeting of the committee of fourteen, which had resulted in the formation of the new Canadian engineers council. One objection he had to the new organization was that it seemed to be undertaking to do practically the work of the Dominion Council. He reported that the Quebec Corporation could not see its way clear to give financial support to such a body. He again emphasized the desirability of a Presidents' Conference Committee with every organization paying its own portion of the costs.

Mr. Poitras seconded the motion and emphasized that in the opinion of the Quebec Corporation the Dominion Council had definite duties to perform and that the Engineering Institute had other definite duties to perform and neither one should lose any of its prerogatives to a new separate council.

Dr. Gagnon supported Mr. Lindsay and Mr. Stirling. He thought there was work to be done by a co-operative committee and that the weight of such an organization could be used from time to time as it was required. He thought there was a better way of organizing such a co-operative group than had been done in the new council. Mr. Lalonde also expressed opposition to the formation of the new council although he approved of a joint committee such as had been recommended by Mr. Lindsay and by the Institute's committee.

The chairman drew attention to the possible desirability of including in the committee's report a recommendation for a Presidents' Conference Committee such as was envisaged in Clause E of the " Statement of Principles and Policy of the Institute on Relations with Sister Societies " which had been prepared by the committee.

After considerable discussion, Mr. Stirling agreed that his report should be revised to include a recommendation as to a Presidents' Conference Committee and undertook to submit such a revised report after the luncheon intermission.

After the intermission Mr. Stirling presented two reports from his committee, the first dealing with the Statement of Principles and Policy of the Institute on Relations with Sister Societies, which had been so unanimously accepted by officers of the Institute and by the provincial professional associations with which the Institute has co-operative agreements. This read as follows:

Statement of Principles and Policy of the Institute on Relations With Sister Societies

During the past several years, there has come to the attention of The Engineering Institute of Canada a number of proposals for promoting co-operation among existing engineering organizations in Canada. These proposals have been referred to the Committee on Professional Interests, which, after careful consideration, has in each case reported its inability to recommend approval by Council. The principal reasons for the Committee's unanimous conclusions were:—

1. The proposals involved the formation of a new body, with headquarters organization and the expense necessarily involved in such an organization and its operations.

2. It appeared either explicitly or implicitly that this expense was to be shared by the constituent bodies on a per capita membership basis, but that representation in the new organization was to be equal regardless of membership.

3. It appeared either that these representatives were to have no power to commit their respective bodies, in which event the new organization would be relatively powerless, or that they were to have full power to commit their respective bodies, in which event their autonomy would either be restricted or nullified.

4. The new organization, although apparently intended as an engineering organization, was to include bodies, a large proportion of whose members were not engineers.

The Committee on Professional Interests is of the opinion that Council should define its position in regard to cooperation by The Engineering Institute of Canada with other engineering organizations. To this end it recommends the following statement of policy:—

A. The Council of The Engineering Institute of Canada will continue to consider on its merits any properly sponsored proposal for co-operative action among engineering organizations for the purpose of promoting the common good of the engineering profession.

B. Believing that cooperation between The Engineering Institute of Canada and the provincial professional associations is a fundamental move toward that end, Council is prepared to work out with each such association a mutually satisfactory agreement.

C. Believing, further, that cooperation between The Engineering Institute of Canada and the several Canadian engineering organizations, the organizations in Canada of the American Founder Societies and others, and the organizations in Canada of the British institutions of engineering, is also a move toward that end, Council is prepared to work out with each such organization a mutually satisfactory agreement.

D. Council is also prepared, at any time, to cooperate with any one or more of the provincial professional associations, and with any other engineering organization or organizations for any special purpose when co-ordinated action is desirable either in the interests of the public or of the engineering profession.

E. 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.

Upon the motion of Mr. Lindsay, seconded by Mr. Lalonde, this was approved unanimously.

The second report dealt with the establishment of a new engineering council and reads as follows:

> " With reference to minutes Nos. 3456 to 3463 of Council at the meeting held in Edmonton, Alberta, on October 21st, 1944, dealing with the matter of a proposal for a new engineering organization, and referred by Minute No. 3463 to the Committee on Professional Interests, I beg to report on behalf of that committee that, after securing the opinions of the past-presidents, vice-presidents, members of Council, and the provincial professional associations with whom the Institute has co-operative agreements, it is recommended that The Engineering Institute of Canada do not participate in the new organization known as " The Canadian Council of Professional Engineers and Scientists ".
>
> As Clause E of the Committee's Statement of Principles and Policy proposes 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 ".

On the motion of Mr. Lindsay, seconded by Mr. Poitras, this report was approved unanimously.

In the long discussion which followed, several suggestions were made. Attention was drawn to the fact that committee's statement of principles referred only to engineering organizations. Mr. Lindsay thought there was something to be said for having representation of the Presidents' Conference Committee of organizations other than those restricted to engineers. He thought that for the time being the statement of principles was adequate but that as the organization was discussed later, thought should be given to including certain non-engineering organizations, although he agreed that care would have to be exercised in selecting those organizations. Mr. Lalonde thought that an effort should be made first to coordinate the various groups representing the engineering profession, through the Institute, through the associations, and through the Dominion Council. He thought that first of all the engineering profession should stand on its own feet. Then, in the future, when there are special reasons for joint action with other groups, arrangements should be made for the necessary co-operation.

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 co-operative 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.

Committee on Professional Interests — Item (b) Meeting with Toronto Executive—Minute 3761: Mr. Stirling reported on a meeting which took place in Toronto on May 4th at which time three members of his committee, namely, J. A. Armstrong, J. A. Vance and himself, together with the general secretary, met with the Toronto executive to discuss a draft of a report on Institute policy which had been drawn up by the branch executive. He reported that the conference was carried out with extreme frankness and splendid cordiality. He was impressed with the fact that there were things about branch activities which the committee had not appreciated previously, and there were many things about Institute policy which were not known to the branch. He was strongly of the opinion that it would be desirable to keep branch executives better informed of things that were going on in the Institute and in the professional circle.

He informed Council that the executive had drawn up a brief making several suggestions of a very far-reaching nature, all of which had been discussed item by item in detail at the meeting. The branch executive was to meet again within a few days' time to reconsider the whole matter in the light of the discussion, after which it was possible that a brief might be presented to Council dealing with some or all of the same subjects. He expressed his appreciation of the other members of the committee for having accompanied him to Toronto, and also of the Toronto executive's fair and frank reception of the discussion offered by members of the committee. Council accepted Mr. Stirling's report and expressed its approval of the action taken.

Mr. Saunders referred to Mr. Stirling's remarks about keeping the branches better informed of what was going on. He suggested that it might be possible to have an insert in *The Engineering Journal* made up solely of news items. Mr. Poitras also expressed approval of some such procedure. The general secretary reported that for over two years the Publication Committee has hoped to have a news section in the *Journal* which could subsequently be produced in reprint form for circulation to engineering students. The Publication Committee realised the importance of such material but had decided not to inaugurate this section until a competent person could be secured to take charge. He mentioned that this was one of the many items it was hoped could be established if the basis of Institute fees were changed to a higher level.

Mr. Poitras inquired as to whether or not the Institute would be prepared to publish in this section news from the Dominion Council and the various provincial associations.

The general secretary's reply was that the committee had already suggested such a policy and, in fact, under instructions of the committee he had written to all the associations three or four years ago stating that the *Journal* would be glad to establish a section of the *Journal* for news of the associations, printing the information exactly as submitted by them. The committee had thought that because the membership of the associations was made up largely of members of the Institute it would be of interest to Institute members to have a complete report of the activities of the Associations. Mr. Wright stated that in reply a letter had been received from the secretary of the Dominion Council stating that the subject had been discussed at a meeting and that it was agreed that the associations should send their material to the secretary of the Dominion Council who, in turn, would send it to the editor of *The Engineering Journal*. He reported that since that time there had been no further word from the Dominion Council relative to this subject.

Community Planning—At the March meeting of Council, following a resolution passed at the annual meeting of the Institute in February, the Toronto councillors, with power to add to their number, had been appointed a committee to recommend to Council the make-up of the committee on community planning authorized by the annual meeting. Since that time the Toronto councillors, W. H. M. Laughlin and W. S. Wilson, together with Vice-President C. E. Sisson of Toronto, Councillor R. A. Low of Kingston, A. E. K. Bunnell of the Ontario Department of Planning and Development and S. R. Frost, past-chairman of the Toronto Branch, had given the matter serious consideration, and had prepared a lengthy and comprehensive report. Mr. Laughlin and Mr. Frost had both intended to be at this meeting to present the report, but at the last minute had found it impossible to attend. On behalf of the committee, the general secretary presented the report, which, after summarizing the general situation, made the following recommendations:

1. That a committee of the Institute be appointed with the following duties:

   (a) In co-operation with other interested groups to establish a national association for the advancement of community planning.
   (b) To encourage and assist branches in setting up local committees.
   (3) To provide material for public addresses and for *The Engineering Journal*.
   (d) To aid in all ways possible the general development and dissemination of information that will assist municipalities to accomplish worthy objectives in this field.

After some discussion, on the motion of Mr. Eadie, seconded by Mr. Poitras, it was unanimously resolved that the report be accepted and approved, and that the president, Vice-President Armstrong and the general secretary be given power to name the members of the special committee on community planning recommended in the report.

Co-operative Agreement in Quebec — Mr. Poitras commented on applications for membership in the Corporation and the Institute which had been received under the terms of the cooperative agreement. Not nearly as many had been received as had been expected, and he suggested that as many more had indicated a desire to participate the time limit for the granting of the special privileges be extended. The Corporation had agreed to do this and would like the Institute to take the same action. Following some discussion, on the motion of Mr. Poitras, seconded by Mr. Lalonde, it was unanimously agreed that the time limit for the granting of such privileges be extended to December 31st, 1945.

Committee on the Young Engineer—The general secretary reported that although negotiations were underway, arrangements were not yet completed in regard to a chairman for the Institute's Committee on the Training and Welfare of the Young Engineer. The member whom it was hoped would be able to act, and who would like very much to take on the work, could not undertake the responsibilities for about eight months, and it has been suggested that in the meantime it might be possible to appoint an acting chairman. Discussions with this in view were now proceeding, and it was hoped that there would be something definite to report at the next meeting of Council. This progress report was noted.

Harry Bennett Memorial—At the last meeting of Council it had been left with the president to select a chairman for the Harry Bennett Memorial Committee, and the general secretary presented a letter just received from the president, in which he suggested that Councillor J. A. Vance be asked to accept the chairmanship and that he be asked to name the other members of the committee. On the motion of Mr. Eadie, seconded by Mr. Flitton, this suggestion was unanimously approved.

Increase in Fees and Branch Finances: Vice-President Armstrong, chairman of the Finance Committee, explained that the committee had had before it for over a year, the question of an increase in the annual fee. Considerable thought had been given to the matter, and he outlined the steps which had been taken in preparing a case to support the proposal. It had been hoped that a definite proposal could have been presented to the annual meeting in Winnipeg, but it was now planned to have something ready for the next annual meeting in Montreal. Even if approved at that meeting and then approved by ballot of the corporate members, it would not be possible to put the increased fee into effect until January 1947.

The committee was making investigations on the following items:

1. Headquarters requirements for additional income.
2. Institute requirements for additional income.
3. Branch requirements for additional income.

Before proceeding any further the committee felt that the matter should now be placed in some detail before the branches with a request for comments and suggestions. It is the members of the branches who, in the end, will have to pay the increased fee, and the committee feels that these members should be consulted. The committee would like authority from Council to prepare and send out a letter with a request for immediate replies, so that the committee may have sufficient time for further study in the light of the replies received from the branches, and for preparation of a report for submission to Council. On the motion of Mr. Lalonde, seconded by Mr. Saunders, it was unanimously resolved that the Finance Committee be authorized to send a letter to the branches as suggested by the chairman of the Finance Committee.

Engineering Journal Contract: The general secretary submitted information regarding the contract with the Gazette Printing Company, for the printing of *The Engineering Journal* under which the Institute is still getting the same terms as were established in 1938. Negotiations with the officers of the Gazette have resulted in the preparation of new scale of costs. The Finance Committee has authorized the general secretary to conclude negotiations with the company involving an increase in the contract price not to exceed a certain proportion of the present contract price. On the motion of Mr. Eadie, seconded by Mr. Flitton, this action was approved unanimously.

Audit Bureau of Circulation: The Finance Committee recommends the expenditure of $98.00 per year to provide for the *Journal* the services of the Audit Bureau of Circulation, replacing the services of the Canadian Controlled Audit Bureau.

Mr. Wright explained the difference in the type of service, and on the motion of Mr. Poitras, seconded by Mr. Eadie, it was unanimously agreed that the recommendation of the Finance Committee be accepted.

Student Conference: The general secretary reported that in accordance with instructions from the March meeting of Council, he had communicated with all the undergraduate engineering societies at Canadian universities to inquire whether or not these organizations would be interested in an invitation from the Council of the Institute to establish a conference of their presidents at the time of the annual meeting of the Institute, part of the cost being paid by the societies themselves, and the balance by the Institute. The replies received from the universities were all in favour of the proposal, and all have expressed willingness to contribute to the cost to the extent of their ability.

The Finance Committee recommends that a specific portion of the cost of such a conference be met out of Institute funds. All members present were in favour of the proposal and, on the motion of Mr. Poitras, seconded by Mr. Flitton, it was unanimously resolved that the recommendation of the Finance Committee be accepted and that the committee be authorized to proceed along the lines suggested.

Alternate Member of Finance Committee: The chairman of the Finance Committee explained that as a matter of convenience in holding meetings it has been the recognized practice of the Institute to have the five members of the Finance Committee located in Montreal. It had been suggested to him that it would be desirable, if possible, to broaden the base upon which the Finance Committee worked by appointing an out of town member or members. In his opinion it was highly desirable that the committee should have the benefit of the opinions and judgment of prominent members outside of Montreal. With this in view he had asked Councillor W. H. M. Laughlin of Toronto to meet with the Finance Committee as an alternate member. Mr. Laughlin had agreed to act and for meetings in Montreal, hoped to arrange to arrive in time to attend the Finance Committee's meeting on Friday night, and remain over for the Council meeting on the following morning.

On the motion of Mr. Eadie, seconded by Mr. Lalonde, Mr. Armstrong's action was approved unanimously.

Quebec Section—Ecole Polytechnique Alumni: The general secretary presented a resolution from the executive of the Quebec Section of the Ecole Polytechnique Alumni requesting the Institute to join with them and the Corporation of Professional Engineers of Quebec in making representations to a sub-committee of ministers of the Province of Quebec government in the matter of salaries of engineers in the civil service. The resolution suggested that the government be requested to adopt, until such time as the Quebec Civil Service Commission has established its own schedule, the schedule prepared last year by the Corporation of Professional Engineers of Quebec and which called for a minimum of $2700.00 a year for engineers in the civil service. Attached to the resolution was copy of a letter addressed to Dean Circe of the Ecole Polytechnique by Mr. Laforce, Commissioner of the Civil Service, in which he explained that, in view of the difficulty of securing engineers for the services of the government at the prevailing rates of pay, it had been decided to offer a minimum of $2200.00 a year. Mr. Laforce asked Dean Circe to publicize this decision among the graduating class.

Mr. Lalonde and Mr. Poitras explained that the resolution from the Ecole Polytechnique Alumni had stemmed from the experience of a group of new graduates who, having accepted an offer of $2400.00 a year as a starting salary with the Quebec government, were subsequently informed that the salary was $2200.00.

After some discussion it was moved by Mr. Poitras, seconded by Mr. Flitton, and carried unanimously that Mr. Lalonde be appointed as the Institute's representative to co-operate with the Corporation and the Alumni in making representations to the proper authorities in this matter.

Additional Councillor for Toronto Branch: The general secretary presented a letter from the secretary of the Toronto Branch, pointing out that as the corporate membership of the branch was now over 400, the branch was entitled to three members of Council. This was noted and found to be in order, but as no recommendation regarding the third member had been received, no appointment could be made at this meeting.

Sir John Kennedy Medal: The general secretary reported that six names had been submitted for consideration for the Sir John Kennedy Medal. He was instructed to send these names out on a preliminary ballot so that one name may be selected to go out on the final ballot.

Julian C. Smith Medal: It was noted that three names had been submitted for the Julian C. Smith Medal, and the general secretary was directed to refer these names to the committee for consideration.

Leonard Medal Committee: The membership of the Leonard Medal Committee, as submitted by the chairman, was approved as follows, subject to the acceptance of each member:

F. V. Seibert, *Chairman*
G. E. Cole
A. E. MacRae
D. H. McDougall
G. W. Waddington

National Construction Council of Canada: On the motion of Mr. Chadwick, seconded by Mr. Poitras, it was unanimously resolved that Mr. D. C. Tennant be reappointed as the Institute's representative on the National Construction Council of Canada.

International Federation of Engineering Institutions and Societies: The general secretary reported that early in 1944 an invitation had been received at Headquarters for the Institute to be represented at a meeting to take place in London to discuss the possibility of establishing an International Federation of Engineering Institutions and Societies. He reported that he had cabled a member in London asking him to attend as an Institute representative, but with a watching brief only. At the same time he had communicated with other societies and individuals in London asking their opinion of the new proposal. He then read to Council extracts from the letter which had been received in reply.

Since then he had received reports from the Institute's representative which seemed to indicate some support from unspecified groups, but there had been no news of any further developments for several months.

On May 17th a cable had arrived from the Institute's representative stating that further meetings had been held in France and that at least two organizations, one French and one English, had indicated a willingness to contribute about $1000.00 each to the establishment of the new federation. A further meeting was to be held in Paris and the Institute's representative was asking for instructions.

After a short discussion, the general secretary was instructed to request that the Institute member attend the meeting if convenient to himself and that he keep the Institute informed without in any way committing it to any definite action. Further reports should be submitted to Council for consideration.

"Mulberry" Harbour Exhibition: The general secretary reported that a very large and complete exhibition of the "Mulberry" harbour project, which had made possible the Normandy invasion, had been prepared and put on exhibition at the headquarters of the Institution of Civil Engineers in London. It had been suggested to the general secretary that it would be a splendid idea if the exhibit could be brought to Canada under the auspices of the Institute.

The general secretary had cabled the secretary of the British institution and the government official responsible for the exhibit and had been informed that arrangements were possible.

The exhibit was a very large affair, so complete that it would take four to five hours to see it all, including the moving pictures. However, the secretary had written for more detailed information as to the size of the exhibit and the conditions under which it could be secured.

Mr. Wright pointed out that this great project was the outstanding secret of the war and perhaps the most important single development in the entire European campaign, and that as it was wholly a British idea and design it should be in the interest of good international propaganda to have it shown very widely in Canada.

ELECTIONS AND TRANSFERS

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

Members

Andrews, George Thomas Leslie, B.Sc. (E.E.), (Univ. of Man.), Blackdale, Alta.

Barchard, Philip Wilson, B.A.Sc. (Chem.), (Univ. of B.C.), asst. chemical supvr., Alberta Nitrogen Products, Ltd., Calgary, Alta.

Cowan, William Kennedy, B.A.Sc. (Univ. of Toronto), sales engr., Aluminum Co. of Can., Ltd., Montreal, Que.

Gibbs, Maxwell, B.Sc. (Civil), (Cooper Union Inst. of Technology, New York), engr., plant layout dept., North American Aviation Co., Los Angeles, California.

Green, John Joseph, B.Sc., A.R.C.S., D.I.C., Ph.D. (London Univ. Royal College of Science), chief research aero. engr., Air Transport Board, Ottawa, Ont.

Greenlaw, John Wilson, B.Sc., E.E., (Univ. of Man.), consultg. elec. engr., Lighting Materials Co., Winnipeg, Man.

Hunt, William Harold, B.Sc., C.E. (Univ. of Man.), district engr., Dept. of Public Works, Province of Manitoba, Winnipeg, Man.

Lindsay, Donald Alexander, B.Sc., E.E. (Univ. of N.B.), Captain with R.C.E., Saint John, N.B.
MacNeil, Reginald J., B.Eng. (Mining), (N.S. Tech. Coll.), supvr., calcination, ore plant No. 2, Aluminum Co. of Canada, Arvida, Que.
Manson, Charles Alexander, B.Sc. (Elec.), (McGill Univ.), Lieut. Colonel, Asst. Dir., Directorate of Artillery, M.G.O. Branch, N.D.H.Q., Ottawa.
Stratton, Dudley Harold, B.Sc. (C.E.), (Univ. of Man.), genl. mgr., Stratton Engineering Co., Limited, Winnipeg, Man.
Warrington, George Albert, B.A.Sc. (Univ. of Toronto), chief surveyor, Dept. of Public Works, Winnipeg, Man.
Williams, Gerald B., B.Sc., C.E. (Univ. of Man.), materials engr., Highway Branch, Dept. of Public Works, Winnipeg, Man.
Young, Dudley Stewart, B.Sc. (Elec.), (Univ. of Man.), S.M., (Mass. Inst. Tech.), development engr., Canada Wire & Cable Co., Ltd., Toronto, Ont.

Juniors

Jefferies, Jack Glenn, B.Eng. (Met.), (McGill Univ.), engr., Aluminum Co. of Canada, Ltd., Arvida, Que.
Kennedy, Thomas Fowler, S/L., B.Sc. (Civil), (Univ. of N.B.), Chief Ground Instructor, R.C.A.F., Penfield Ridge, N.B.
Parlee, Norman Allen Devine, B.Sc. and M.Sc. (Dalhousie Univ.), Ph.D. (Chem.), (McGill Univ.), asst. chief metallurgist, Dominion Steel & Coal Corp., Sydney, N.S.
Wood, John Richard, B.Sc. (Elec.), (Univ. of Alta.), student engr., Canadian General Electric Co., Ltd., Peterborough, Ont.

Transferred from the class of Junior to that of Member

Carrick, Stanley Mirus, B.Sc. (Civil), (Univ. of Man), design engr., C.P.R. (post-war projects), Winnipeg, Man.
Chaplin, Herbert Elliott, B.Eng. (Elect.), (McGill Univ.), factory engr., Imperial Tobacco Co. of Can., Ltd., Montreal, Que.
Cowan, George Archibald, B.Eng. (Univ. of Sask.), sales and service engr., Railway & Power Engrg. Corp., Ltd., Winnipeg, Man.
Girdwood, Arthur James, B.A.Sc. (Univ. of Toronto), designing engr., Canadian Genl. Elec. Co., Ltd., Peterborough, Ont.
Hamilton, Harold Percy, B.A.Sc. (E.E.), (Univ. of Toronto), designer and dftsman., Hudson Bay Mining & Smelting Co., Flin Flon, Man.
Harvey, Ernest Allan, F/L., R.C.A.F., B.Sc. (Univ. of Sask.), B.Sc., E.E. (Univ. of Man.), 11355 Chemin Laval, St. Laurent 9, Que.
Thomas, James MacLeod, B.Sc. (Elect. and Civil), (Univ. of N.B.), designing engr., Foundation Co. of Canada, Montreal, Que.
Tweeddale, Reginald Estey, F/L., R.C.A.F., B.Sc. (E.E.), (Univ. of N.B.), Technical Signals (Radar), Perth, N.B.
Whiteley, Eric, B.A.Sc. (Univ. of Toronto), asst. D.C. engr., Canadian Genl. Elec. Co., Ltd., Peterborough, Ont.

Transferred from the class of Student to that of Member

Jarrett, William Frederick, B.Sc. (E.E.), (Univ. of Man.), elec. engr., Saguenay Power Co., Ltd., Isle Maligne, Que.
Mullen, Thomas James, Jr., B.Eng. (Mech.), (McGill Univ.), industrial mgr., B. F. Sturtevant Co., Western Div., Inc., 602 Wrigley Bldg., Chicago, Ill.
Rule, Russell A., Major, B.A.Sc. (Civil), (Univ. of Toronto), Directorate of Works and Constrn., N.D.H.Q., Ottawa, Ont.

Transferred from the class of Student to that of Junior

Bourgeois, Patrick O., B.Sc. (Civil), (Queen's Univ.), fld. engr., International Water Supply Ltd., London, Ont.
Hamilton, Harry Irwin, B.Sc. (Queen's Univ.), tech.. engr., Demerara Bauxite Co., Mackenzie, British Guiana.
Garton, John McConnell, B.Eng. (McGill Univ.), research staff, Imperial Oil Ltd., Sarnia, Ont.
McNally, Reginald Winnett, B.Sc. (Mech.), (Univ. of Sask.), detail and design engr., Mathews Conveyer Co., Port Hope, Ont.
Morris, Ronald William, Capt., R.C.E.M.E., B.Sc. (Elect.), (Univ. of Man.), Tech. Staff Officer, Cdn. Military Hdqts., Canadian Army Overseas.
Russell, Harold George, B.Eng. (Chem.), (McGill Univ.), process engr., Bahrein Petroleum Co., Bahrein Is., Persian Gulf, 2358 Grand Blvd., Montreal, Que.
Schneider, Reinhold Roy, Lt. (E), R.C.N.V.R., B.Sc., M.E. (Univ. of Sask.), H.M.C.S. Givenchy, F.M.O., Esquimalt, B.C.
Swallow, Murray Gordon, B.Sc. (Civil), (Univ. of Alta.), dftsman, Gaspésia Sulphite Co., Ltd., P.O. Box 10, Chandler, P.Q.
Valiquette, Maurice-Louis, B.A.Sc., C.E. (Ecole Poly.), engr. i/c ship's constrn., Marine Industries Ltd., Sorel, Richelieu, P.Q.

Admitted as Students

Bennett, Graham Alward (N.S. Tech. Coll.), 32 Rosebank Ave., Halifax, N.S.
Cranton, Cecil Smith (Mt. Allison Univ.), Mt. Allison Univ., Sackville, N.B.
Graham, Verne Allister (N.S. Tech. Coll.), 27 York St., Halifax, N.S.
Harris, William Fred., S/Lt., Elect., R.C.N.V.R. (N.S. Tech. Coll.), 119 Duncan St., Halifax, N.S.
Hurter, Alfred Max (McGill Univ.), 79 Hudson St., Town of Mt. Royal, Que.
Mallory, Richard Frederick (Univ. of N.B.), R.R. No. 6, Woodstock, N.B.
McLean, Donald Fraser (N.S. Tech. Coll.), P.O. Box 402, Moncton, N.B.
Plummer, David Kent (Univ. of N.B.), 214 Pitt St., Saint John, N.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.

New Brunswick

Junior to Member

Whiteway, Lorne B., B.Sc. (Elec.), (N.S. Tech. Coll.), Dept. of Transport, aerodromes, Moncton.

Nova Scotia

Members

Baker, Max Leo, B.Sc. (Mech.), (N.S. Tech. Coll.), asst. prof. mech. engrg., N.S. Tech. College.
Crooks, C. M., staff engr., Maritime Telegraph & Telephone Co., Ltd., Halifax, N.S.
Hicks, Milledge Stevens, B.Eng. (E.E.), (N.S. Tech. Coll.), elec. instructor, Canadian Vocational Training Programme, N.S. Tech. College.
McLaughlin, Ivan Murray, B.E. (Mech.), (N.S. Tech. Coll.), Elec. and mech. engr., M.D. No. 6, R.C.E.M.E., Halifax, N.S.
Mulcahy, Robert Rolland, B.Sc. (Mining), (Queen's Univ.), resident engr., Dept. National Defence, H.M.C. Dockyards, Halifax, N.S.
Vye, Donald Montgomery, B.Sc. (Mt. Allison Univ.), second in command of No. 8 Constructing and Mtce. Unit, R.C.A.F., Tufts Cove, N.S.
Williams, Victor Thornton Beck, B.Eng. (Mech.), (N.S. Tech. Coll.), dist. engr., Sydney branch, Canadian Ingersoll-Rand Co., Ltd.
Woollcombe, Edward Mickle, B.Sc. (Mech.), (McGill Univ.), genl. mgr., Foundation Maritime Limited & Maritime Towing & Salvage, Ltd., Halifax, N.S.

Quebec

Members

Corriveau, Gerard, B.A.Sc. (Met.), (Laval Univ. Sch. of Mines), 1940 Calvert St., N.W., Washington, D.C.
Daoust, Roland J. Omer, B.Sc.A. (Ecole Polytechnique), civil engr., Dept. of Roads, Plessisville, Que.
Desrosiers, Paul Real, B.A.Sc., C.E. (Ecole Polytechnique), design office, Canadair Limited, Montreal, Que.
Larose, Claude, B.A.Sc., C.E. (Ecole Polytechnique), divisional engr., Dept. of Roads, Napierville, Que.
McDonald, Floyd Robert, B.A.Sc. (Univ. of Toronto), mgr., mech. division, Peacock Bros. Limited, Montreal.
Simmons, William Raymond, B.Sc. (Elect.), (Univ. of Toronto), asst. supt., power dept., Montreal Tramways Co., Montreal, Que.

Student to Member

Boileau, Charles Antoine, B.A.Sc., C.E. (Ecole Poly.), fld. engr., Atlas Construction Co., Montreal, Que.

Saskatchewan

Member

Edmunds, Frederic Harrison, M.Sc. (geology), (Liverpool Univ.), prof. of geology, Univ. of Sask., Saskatoon, Sask.

Junior

Miners, Everett Laverne, B.Eng. (Civil), (Univ. of Sask.), asst. genl. mgr., C. M. Miners Construction Co., Saskatoon, Sask.

Students

Carbert, John Mervyn (Univ. of Sask.), 415 Cumberland Ave., Saskatoon, Sask.
Horner, William James (Univ. of Sask.), Qu'Appelle Hall, Univ. of Sask., Saskatoon, Sask.
Hudd, Bruce Murdock (Univ. of Sask.), 415 Cumberland Ave., Saskatoon, Sask.

Junior to Member

Thompson, Charles M., B.Sc. (Univ. of Sask.), transitman, Canadian Pacific Railway Co., Regina, Sask.

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

Marc Boyer, M.E.I.C.

Marc Boyer, M.E.I.C., has recently been appointed registrar of the Corporation of Professional Engineers of Quebec. He succeeds C. L. Dufort, M.E.I.C., who has retired after occupying the position for the past seven years.

Mr. Boyer graduated from l'Ecole Polytechnique de Montréal in 1928 and did post-graduate work at McGill University. He was successively in the employ of the Quebec Streams Commission, the Consolidated Mining and Smelting Company at Trail, B.C., the Quebec Department of Mines, and the Quebec Civil Service Commission where he served as a commissioner. Mr. Boyer is also secretary-treasurer and member of the Board of the Quebec Federation of Professional Employees in Applied Science and Research.

Alex. A. Young, M.E.I.C., Director of Works and Buildings, Naval Service, Ottawa, and **Commander Pierre Beaudry,** M.E.I.C., Director of Maintenance, Naval Service, have resigned their positions and will resume peacetime activities. Due to the condition of the war a reorganization of activities in the Navy has caused an amalgamation of the two directorates which they headed. **James Dick,** M.E.I.C., has been appointed director of this new directorate which is called Construction and Maintenance. Mr. Dick was formerly assistant director of Works and Buildings.

Major F. A. Fleming, M.E.I.C., is retiring from the R.C.E.M.E. Corps to return to civilian life. Following a period with the Canadian General Electric Company in the test and engineering departments, Major Fleming joined the Canadian Army in 1939, was appointed as Technical Staff Officer and immediately organized and administered an electrical engineering inspection department. As a member of the R.C.E.M.E. Corps he has been engaged for the past year in the maintenance and repair of automotive and armoured fighting vehicles, guns, carriages, small arms and fire control equipment.

Major R. M. Murray, M.E.I.C., formerly engineer, design section, Directorate of Works and Construction, N.D.H.Q., Ottawa, has retired from the corps of the Royal Canadian Engineers. He has accepted a position with Building Products Limited at Montreal, Que.

Dr. Paul E. Gagnon, M.E.I.C., councillor for Quebec Branch, presents the Leonard Medal of the Institute to Dr. P. E. Auger at the annual dinner of the Canadian Institute of Mining and Metallurgy in Quebec City. At the right is Dr. A. E. Cameron, M.E.I.C., of Halifax, president of the Mining Institute.

E. L. Johnson, M.E.I.C., who was previously works manager, Montreal Works, of Defence Industries Limited is now with Continental Can Company of Canada Limited at St. Laurent, Que.

F. C. Mechin, M.E.I.C., has been made a director of Imperial Oil Limited. He holds the position of assistant to the president, in charge of Employee Relations and Personnel, of the company in Toronto, Ont.

H. F. Finnemore, M.E.I.C., assistant chief electrical engineer, Canadian National Railways, has been appointed to succeed R. G. Gage, chief electrical engineer, who has retired. A graduate of Queen's University, Mr. Finnemore enlisted in the first world war with the Canadian Engineers in 1914. On demobilization in 1918, he joined the Canadian Government Railways at Moncton, N.B., as a draughtsman in the electrical engineering department. Five years later he became assistant electrical engineer in the Canadian National Railways mechanical department at Montreal, and, in 1938, electrical engineer. Two years ago he was appointed assistant chief electrical engineer. He has been actively engaged in the development of electric motive power and installations and the introduction of air-conditioning on the Canadian National passenger equipment.

H. F. Finnemore, M.E.I.C.

Lieutenant W. J. Fargo, Jr.E.I.C., who returned from overseas in February has been appointed Brigade R.C.E.M.E. Officer for No. 1 Training Brigade Group at Debert, N.S.

D. D. Livingstone, Jr.E.I.C., has accepted the position of refinery chemist with the Bahrein Petroleum Company Limited, Bahrein Island, Persian Gulf. He was formerly laboratory assistant with the Madison Natural Gas Co. Ltd., at Turner Valley, Alta.

David A. Stevenson, S.E.I.C., a recent graduate in civil engineering from Nova Scotia Technical College, has enlisted in the Royal Canadian Engineers. He is at present stationed at Petawawa, Ont.

John O. Emmerson, S.E.I.C., has resigned his position with De Havilland Aircraft of Canada Limited at Toronto, Ont., to accept a commission with the Corps of the Royal Canadian Electrical and Mechanical Engineers. He is at present stationed at Barriefield, Ont.

Guy Poitras, S.E.I.C., is now employed in the hydraulic service, Department of Lands and Forests, Quebec, Que. He graduated from Ecole Polytechnique in 1944.

E. O. Wood, S.E.I.C., has accepted a position with the Ontario-Minnesota Pulp and Paper Co., at Fort Frances, Ont.

D. A. Fraser, S.E.I.C., who last month graduated in civil engineering from the University of British Columbia, is at present employed as transitman with the Canadian Pacific Railway at Nelson, B.C.

D. F. Lillie, S.E.I.C., is now employed as metallurgist by Waite Amulet Mines Limited at Noranda, Que. He was formerly with the Aldermac Copper Corporation, Sherbrooke, Que.

Robert A. Begg, S.E.I.C., who has been with Hamilton Bridge Company, Hamilton, Ont., is now employed by the Dominion Bridge Company at Lachine, Que.

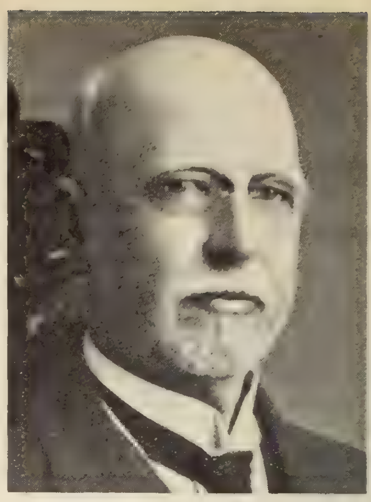
Obituaries

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

James Edgar McKenzie, M.E.I.C., died on December 11th, 1944, in Banff, Alta. Born in Calgary, Alta., on June 29th, 1889, he attended St. John's College, Winnipeg, and in 1912 graduated from Queen's University with his B.Sc.

During the year after graduation he was associated with Stanton & McKenzie, structural engineers, at Calgary. From 1913 until 1917 he was president and chief engineer of Thomas-Jamieson-McKenzie Ltd., general contractors and engineers. He was in charge of all engineering and construction work, and during his last year with the firm he was in charge of grain elevator construction. For the four years following he served as president and managing director of J. E. McKenzie Ltd., general contractors and engineers. In 1932 Mr. McKenzie joined the E. J. Ryan Contracting Co. Ltd., Vancouver, as chief engineer and estimator where he remained for ten years, his work being principally concerned with water power, sewer and water works. For the past three years he had been practising as a consulting engineer.

Mr. McKenzie joined the Institute as a Student in 1912, transferring to Associate Member in 1918 and to Member in 1936.



Herbert Charles Burchell, M.E.I.C.

Herbert Charles Burchell, M.E.I.C., one of the senior members of the Institute, died at his home in Windsor, N.S., on April 28th, 1945. Born in Sydney, N.S., on August 7th, 1855, he was educated at Mount Allison and McGill universities.

Beginning his career in Halifax as assistant to the provincial engineer, Mr. Burchell subsequently held important positions in Colorado, Chicago, Newfoundland and British Honduras. When in Newfoundland he was employed as government engineer and, in British Honduras, he held the position of director of public works. He was offered and declined the position of director of public works in Jamaica. On his return to Sydney, N.S., he founded the Eastern Lime Company, which was afterwards moved to Windsor and of which he was managing director until the time of his death.

Mr. Burchell joined the Institute as a Member on June 9th, 1887, the year of its foundation as the Canadian Society of Civil Engineers.

Hugh T. Hazen, M.E.I.C., died at his home in Oakville, Ont., on May 3rd, 1945. He was born at Truro, N.S., on March 14th, 1870.

Mr. Hazen had been engaged in railway work for 48 years having been connected successively with the Ottawa and Gatineau Valley Railway, Restigouche and Victoria Colonization Railway, New Brunswick Trunk Line Railway and St. Lawrence and Adirondack Railway. For several years, he had been associated with the Canadian National Railways. After serving as acting chief engineer for the eastern lines he was appointed to the position of assistant chief engineer in 1923. In 1932 he moved to Moncton as the railway's chief engineer for the Atlantic region where he remained until his retirement in 1938.

Mr. Hazen joined the Institute as an Associate Member in 1896, transferring to Member in 1906. In 1939 he was made a Life Member.

Edward Henry Morley, M.E.I.C., died on April 8th, 1945, at his home in Yarmouth, N.S. Born in Derby, England, on June 10th, 1863, he received his education in England.

After serving his apprenticeship from 1881 until 1887 in Manchester he was engaged for some time in the design of rolling mills. He was subsequently works manager with Messrs. Herbert & Co., Edinburgh, in charge of the drawing office and shops. In 1894 he came to Canada where he was employed by Messrs. Matheson

& Co., New Glasgow, as head draughtsman. In 1904 he became associated with the Acadia Coal Company as chief mechanical engineer, where he remained until his retirement.

Mr. Morley joined the Institute as a Member in 1910, becoming a Life Member in 1933.

John Hamilton Ryckman, M.E.I.C., died in Chicago, Ill., on January 30th, 1945. Born in Wentworth County, Ont., on January 9th, 1886, he graduated from the University of Toronto in 1906.

After graduation he was employed as structural draughtsman with the Canada Foundry Co., Toronto, until 1908 when he worked as inspector with the Canadian Inspection Co. in Montreal. After another short period spent in Toronto he went to Chicago, Ill., where he was employed until his return to Canada in 1913. For four years he worked as a designer and draughtsman in the Department of Works, City of Toronto. From 1917 until 1919 he was associated with the Algoma Steel Corporation, Sault Ste. Marie, Ont., in the design and construction of buildings, blast furnaces, steel mill and coke ovens. In 1919 he returned to Chicago and in December of that year entered the Department of Public Works, City of Chicago, as designing engineer. He remained with the Department until the time of his death, having held the position of assistant engineer of water works design since 1926. During his term with the City of Chicago he was responsible for the engineering design of several of the large, modern pumping stations.

Mr. Ryckman joined the Institute as an Associate Member in 1917, transferring to Member in 1920.

Alfred Arthur Mills, Affil.E.I.C., died on October 14th, 1944, at Verdun, Que. Born in Midhurst, Sussex, England, on January 23rd, 1895, he graduated in engineering from Bennet College, Sheffield, Eng., in 1923.

Mr. Mills was a partner in a general engineering shop in England until 1926 when he was employed by the St. Hyacinthe Engineering works of Montreal as mechanical draughtsman. In 1930 he was engaged by the Quebec Provincial Government as a draughtsman and plan surveyor in the Boiler and Pressure Vessel Inspection Branch in Montreal which position he held at the time of his death.

Mr. Mills joined the Institute as an Affiliate in 1943.

Arthur Crumpton died at his home in Weston, Ont., on February 16th, 1945. Born in Toronto on January 1st, 1869, he commenced work with the Grand Trunk Railway at Toronto in 1883 and continued with that company and the Canadian National Railways until his retirement in 1926. His first position was that of junior clerk and he later became a draughtsman. In 1889 he was appointed assistant engineer at Port Hope, which position he held until he was transferred to Montreal in 1916 as assistant valuation engineer. Two years later he became valuation engineer which position he held until his retirement in 1926.

Mr. Crumpton joined the Institute as an Associate Member in 1895 transferring to Member in 1911.

News of the Branches

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

BORDER CITIES BRANCH

F. J. Ryder, M.E.I.C. - - *Secretary-Treasurer*
J. G. Hoba, Jr.E.I.C. - - *Branch News Editor*

At the regular monthly meeting of the Border Cities Branch held on April 19th, 1945, Mr. W. N. Witheridge, director and chief engineer of the Bureau of Industrial Hygiene, Detroit Department of Health, submitted a paper entitled **Industrial Process Ventilation, Control of Dusts, Fumes, Mists, Vapours and Gases.** There were 33 members and guests present who took part in an active discussion following the presentation of the paper and the accompanying slides. It is likely that this paper will appear in the *Journal* shortly for the benefit of all members.

HALIFAX BRANCH

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

On March 22nd, 1945, the regular monthly meeting of the Halifax Branch was held at the Nova Scotian Hotel. The attendance was 82, including several members of the Senior Class of the Nova Scotia Technical College who were guests of the Branch.

The guest speaker, Mr. F. G. Hildebrand, personnel manager of the Bell Telephone Company of Canada was introduced by the branch chairman, L. E. Mitchell.

Mr. Hildebrand's subject **Improving Personnel Relations in Industry** is one of vital interest, especially at this time. The topic was exceptionally well covered by the speaker and the great interest with which it was received was evident throughout.

At the conclusion of Mr. Hildebrand's talk, the meeting was opened for any questions and an exceedingly interesting period was enjoyed by those present.

Squadron Leader W. C. Risley moved a vote of thanks to the speaker for his very informative address. This was seconded by A. Myra.

Following this a C.P.R. film entitled "Coast to Coast" was shown.

The presidential visit to the Halifax Branch marked the dinner meeting at the Nova Scotian Hotel on April 13th, 1945. This meeting was attended by 123 persons.

The presidential party consisted of: President E. P. Fetherstonhaugh, Dr. L. Austin Wright, J. B. Stirling, and G. L. Dickson.

Guests for this occasion included representatives of the Army, Navy, Air Force, the Mayor of Halifax, and several students of the graduating class of the Nova Scotia Technical College.

After the Mayor welcomed the presidential party, L. E. Mitchell, chairman of the Halifax Branch, introduced President Fetherstonhaugh, who spoke on **The Educational Trends in Engineering.** In addition, he mentioned the *Journal*, the activities of E.I.C., and the Branches.

Following the president's address those present were pleased to hear from J. B. Stirling, G. L. Dickson, and Dr. Wright, all of whom discussed items of considerable interest.

At this meeting the president was pleased to welcome several former students of the University of Manitoba, and also to extend the greetings of the Winnipeg Branch.

President Fetherstonhaugh visits Cape Breton Branch. Left to right: The president, M. F. Cossitt, chairman, Geo. Dixon and Secretary Gordon Naish.

LETHBRIDGE BRANCH

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

The Lethbridge Branch held their regular monthly meeting in the Marquis Hotel on Friday, March 23rd. when an excellent address was given by Dr. J. A. Allan, Professor of Geology, University of Alberta. The subject for the evening was **Economic Aspects of the Yellowknife Development** which was of considerable interest to people of this part of Canada.

Dr. Allan introduced his subject with a general description of the countryside. Yellowknife is located on the north arm of the Great Slave Lake and approximately 90 miles due north of Lethbridge and 275 miles south of the Arctic circle. In latitude it is about due west of Bergen and Archangel. The climate is extreme in both winter and summer, although precipitation is light, averaging from eight to ten inches yearly. Vegetation is similar to that around Edmonton.

The north country is opened up in islands of settlements of which Yellowknife is one, not necessarily the most important, but in a fine central position. Mountain building movements have caused metamorphosis in the rocks as well as faults and intrusions. The faults and dykes are remarkable in that they extend for many miles in an almost straight line.

There are many minerals in this area, the chief being gold, tantalum, tungsten, copper, lead and zinc. At present no mines are in operation due to labour shortage, although 90 new companies were incorporated this past year, bringing the total up to 137. The past two years have been devoted to diamond drilling exclusively. Some excellent showings have been unearthed. However, transportation is and will always remain a difficult obstacle. Most materials are moved by water which is open only during the months from May to August. A highway from Peace River would not reduce transportation costs, but would lengthen the season. Power is also expensive. There are some excellent hydro sites which would be good for six months of the year. However, the greatest hope is for the discovery of coal or oil in the Paleozoics to the west.

The speaker was introduced by N. H. Bradley and thanked by T. E. Miard. Vice-chairman P. E. Kirkpatrick presided.

The last regular meeting for the current year was held April 27th. This consisted of a dinner meeting, to which the ladies were invited. Entertainment was furnished by vocalists in addition to a dinner orchestra. Community singing was lead by R. S. Lawrence.

A short coloured film entitled "The Life-Line of a Nation" was shown. This was followed by an address by R. E. Gard of the Department of Fine Arts, University of Alberta, who chose as his subject **Some Alberta Yarns**. The speaker was introduced by A. Branch and thanked by D. Hamelin.

At the conclusion of the evening A. L. H. Sommerville, chairman for the past year, turned the meeting over to the incoming chairman, P. E. Kirkpatrick.

LONDON BRANCH

A. L. Furanna, M.E.I.C. - *Secretary-Treasurer*
G. N. Scroggie, M.E.I.C. - *Branch News Editor*

The Production of Electrical Current Indicating Instruments in Canada was the subject of a talk by A. L. Furanna, given at the April meeting of the London Branch. Mr. Furanna, instruments division engineer for Sparton of Canada Limited, gave his talk in Sparton's Cafeteria. Assembled instruments and their component parts were on display and along with many carefully prepared diagrams, were referred to by the speaker.

The speaker told how Canada had relied upon her neighbours for much equipment during peace time so that in the early stages of this war (her neighbour being hard pressed to supply her own demands) she had to start manufacturing instruments which required special machines, special tooling, designing, training and production technique. This was done in a surprisingly short time and at a high cost, the first meter costing $110,000.

Mr. Furanna stated that the key problem in instrument work is one of size and the accuracy to which small parts must be made. Instruments in wartime electronic equipment have two prime functions, the first being to indicate actual operating conditions of the final output of the equipment. That is, by reference to standard procedures, a relatively unskilled operator is able to operate highly complicated equipment simply by adjusting controls to give certain predetermined instrument indications. This method of operating has made it possible to train men to use the equipment efficiently in a very short time. The second chief usage is in connection with service and repairs. Under battle conditions it is imperative that repairs be made quickly.

In radar equipment, for example, the metering of each of the critical or control circuits allows the rapid detection of the faulty parts.

Following the talk, the members were conducted through the plant and were shown how the instrument parts were made and assembled. After the tour through the plant, V. A. McKillop thanked the speaker, and the members were then served lunch in the company cafeteria.

THE PRESIDENT AND MRS. FETHERSTONHAUGH VISIT HALIFAX

Manitoba graduates greet the president: Major G. S. Baldry, Lieut. D. W. Laird, Lieut. J. R. Waldron, Lieut. R. Jeske, Lieut. E. Parker, Lieut. R. Tivy, Lieut. A. Swan, Lieut. J. C. Pratt, Lieut. B. Guttormson, Lieut. D. E. Palmquist, Lieut. L. F. Cull, A. W. Walkley, Lieut. R. R. Dobesch.

Left to right: H. W. L. Doane, K. L. Dawson, P. A. Lovett.

Left to right: S. W. Gray, E. L. Cousins, K. Forbes.

P. A. Lovett and Rear Admiral L. Murray

Shore dinner, reading clockwise: Mrs. March, Mrs. O'Leary, G. J. Currie, Patricia Goff, Cliff Martin, Jean Doane.

The president attacks his lobster with L. G. Mitchell on his left, followed by Mrs. Fetherstonhaugh and H. A. Ripley.

PRESIDENTIAL VISIT TO SAINT JOHN

Mrs. Fetherstonhaugh responds to the toast "The Ladies", with Mrs. A. A. Turnbull on her left.

Head table, left to right: Capt. J. A. Heenan, the president, C. D. McAllister, chairman, Mayor McKenna and Mrs. Fetherstonhaugh. Mrs. Oscar Wolfe is in the foreground.

T. C. McNabb proposed the toast to the ladies. Mrs. McNabb on his left and Victor Chesnut.

Prof. Stevens of the University of New Brunswick considers the president's question

At Fredericton: F. Davidson, president of the engineering society.

Left to right: Mrs. Wolfe, Oscar Wolfe and Mrs. McKenna, wife of the mayor.

THE PRESIDENT AT MONCTON

Left to right: Mrs. Fetherstonhaugh, the president, G. A. Dixon, Mrs. A. S. Donald, Past-President H. W. McKiel.

Right to left: The Hon. Michael Dwyer, A. E. Flynn of Halifax.

Oyster supper at Buctouche—some new records were made.

At Wolfville, N.S., the president poses with Bernard Cain, acting dean of engineering at Acadia.

Mrs. T. H. Dickson, Mrs. Fetherstonhaugh, E. C. Percy, and L. E. Mitchell enjoy the oyster supper at Buctouche.

At Buctouche in the interval between oysters and chicken.

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. - - - }

The Perpetual Harvest was the subject of a paper read before the Montreal Branch on Thursday, April 5th, 1945, by R. L. Weldon, president and managing director of Bathurst Power & Paper Co. Ltd. Mr. Weldon is also chairman of the executive board of the Canadian Pulp and Paper Association.

The pulp and paper industry was born in Canada in the early years of the 19th century and it has grown in 1939 to be one of our leading manufacturing industries. During this period the industry employed more than 30,000 men and ranked second only to the sawmills as Canada's leading industrial employer.

Of the total world production of pulp in 1937 of 28,000,000 tons, Canada produced, Mr. Weldon pointed out with the help of graphs, about 8,500,000 tons or about one-third. During this same period of time, the industry paid out in salaries and wages over $42,000,000 each year. Seventy-five per cent of all the pulp produced that year found its way into newsprint.

Mr. Weldon told about the enemies of the forest, the chief of which is fire. Since it is impossible to put out a forest fire once it has started, prevention is the main weapon in the fight. The training, the work done, and the living conditions of the woods worker were then described in a coloured movie by the Bathurst Power and Paper Co.

Plans for the future include more jobs for Canadians and more time and energy spent in research. This research will be in the application of pulp and paper products and the development of new uses for these materials.

The chairman of the meeting, F. S. B. Heward, introduced the speaker by telling of the important role played by engineers in the pulp and paper business from the start of field operations to the production of finished paper products. There were 110 members present.

Dr. John B. Wilbur, acting head of the Department of Civil and Sanitary Engineering of the Massachusetts Institute of Technology, and chief engineer for S. Morgan Smith on the Smith-Putnam wind-turbine project, gave a most interesting talk to the members of the Montreal Branches of the E.I.C. and A.I.E.E. on Thursday, April 12th, 1945, on the erection and operation of the 1,000 kw. test generators.

One of the many reasons for choosing this site, Grandpa's Knob, was its accessibility. The unit consists of a two-bladed propeller on a steel tower hooked up to a generator. The blade is 175 feet in diameter and the hub stands about 210 feet above the ground level.

The unit was made in sections and hauled up the two-mile mountain road built for this purpose. Bridgeworkers did the erection and assembly of the pieces, the heaviest section of which weighed 43 tons. One particularly delicate piece of work, shown with coloured movies, involved the placing of a vertical shaft 18 inches in diameter into its bearing. This bearing was about 200 feet from the ground, had .005 inches clearance and the shaft assembly weighed several tons. The assembly was lowered into position by crane.

An 18-mile-an-hour wind will generate 100 kw. and since the normal speed of rotation is 30 r.p.m. to deliver 1,000 kw., the blades can be feathered to keep this speed in high winds. The synchronous generator is geared to the propellor shaft with a 20 to 1 gear drive to give a speed of 600 r.p.m. Governors keep the generator speed within limits to deliver AC current at constant voltage. Speed control is very important when it is remembered that the energy output varies as the cube of the wind velocity. The operation of this unit is limited to two-thirds of the time because of insufficient wind velocity the rest of the time.

During the discussion which followed, we learned that increasing the number of blades to three would increase the power delivered by about 3 to 4 per cent, but the cost of the unit would have been about 10 per cent more. An interesting engineering detail is the hinge points about which the blades pivot to relieve some of the strain of wind pressure. The angle of deflection of the blades during normal operation is about 7 deg.

There were 200 persons present who enjoyed the talk and the commentary on the film. The members present observed a one-minute silence, mourning the death of Franklin Delano Roosevelt.

On Wednesday evening, April 18th, 1945, a joint meeting of the Montreal Branch of the E.I.C. and the Statistical Quality Control Association was held to hear a talk on the **Progress of Quality Control in Great Britain During the War,** given by Dr. John R. Womersley, head of the Advisory Service on Quality Control of the British Ministry of Supply.

Dr. Womersley, who is one of the world's leading authorities on this subject, spoke on the different types of inspection and how they are carried out.

The first stage is raw material inspection, to check that the raw material arrives up to specification. Small parts is another branch of inspection that has to do with checking the suitability of small parts made by sub-contractors and incorporated into larger assemblies by the parent company. Periodic inspection during production is necessary to eliminate lost time in working of parts that have become unfit for use. The most important stage is final inspection which seeks to ascertain whether or not the product will function according to prearranged standards. Inspection must be done conscientiously as men's lives depend on the accuracy and strength of our fighting material.

The meeting was opened by J. A. Beauchemin and the speaker was introduced by S. L. Burns. There were 85 persons present.

Factual Analysis of the Tennessee Valley Authority was the subject of a paper presented by Mr. Huet Massue before the Montreal Branch on April 26th, 1945.

Mr. Massue stated that the Tennessee Valley Authority is not the success it is said to be. Whatever progress was accomplished in recent years in the Tennessee Valley Region was the result of the artificial prosperity brought about by the war, and not the result of TVA's activities. Once peace returns, economic conditions in the Valley will be just about as they were before the expenditure by the government of one billion dollars, for power, navigation, and flood control, except that there will be a large surplus of power.

The electric rates enforced by the TVA do not at all represent the cost of the service; in fact, if the government had wanted to carry its philanthropy further, it could just as well have given electricity entirely free and increase its taxation accordingly.

The enforcement of this false "yardstick of cost electricity" in the Tennessee Valley cannot but have a most detrimental effect on all privately-owned utilities in the country, and cannot but increase the loss of confidence in all democratic institutions.

No matter how low electric rates will be, they will not attract to the Tennessee Valley the industries to which the Atlantic Coast and the Great Lakes regions owe their higher economic status.

Through a series of coloured slides, Mr. Massue dealt with the various phases of the undertaking from its inception to the present time.

It was indicated that when the TVA was formed in 1933, its main purpose was the management of a large hydro-electric plant (Wilson Dam) and two fertilizer plants, which the government had constructed, at the end of World War No. 1, at Muscle Shoals, Alabama. When, at the end of 1936, Wilson Dam was transferred to the TVA for $31.5 millions, its cost to the government of the United States, including interest charges and operating losses, exceeded $85 millions.

On June 30th, 1944, the TVA reported having required for its development a total of $783 millions. If operating losses, loss in taxation, and interest charges are added, the TVA experiment is found to have cost about one billion dollars of which $395 millions, or only 40%, is allocated to power development.

The TVA has now an installation of 1,894,000 kw. of which 1,500,000 kw. is hydro power and 394,000 kw. steam power.

It was on the basis of an investment of $395 millions that in its 1944 Annual Report, the TVA was reporting that its operating income of $14,737,000 represented a return of slightly more than 4% on the average investment in power facilities.

When the cumulative effect of loss in taxation and interest charges are considered, the annual cost of operating the TVA is not the reported $28.2 millions, but $61.3 millions. So, when $20.7 millions are allocated to power operations, this activity is made to bear only one-third of the total cost of operating the TVA.

The yearly operation of the Tennessee Valley Authority is costing the citizens of the United States about $25 millions more than is obtained from the sale of electricity. With the end of the war, this amount should increase considerably, for, at the present time 75 per cent of the total production is used for war purposes, and it should take quite a long time after the war, to find a remunerative market for that power. If electricity users in the Tennessee Valley were made to bear the full cost of operation of the Tennessee Valley Authority, the rates would have to be much higher than anywhere in the country, in fact, they would be exorbitant.

Much has been said about the benefits accruing to transportation on the Tennessee River. Again, when the true cost of navigation to the government is considered, it is found to be at least three times more costly than railroad transportation and even more onerous than highway transportation.

Flood control on the Tennessee has benefited from the construction of the several dams throughout the watershed. It is said, however, that the permanent flooding of about 1,000,000 acres of land has resulted in an annual loss in agricultural production, greater than the damage that used to result from the temporary floods in the Valley.

Regarding the benefits being derived from the operations of the Tennessee Valley Authority, it was shown that the economic status of the people immediately before the war was not any higher than it was a few years preceding the advent of the TVA.

In closing, the speaker sounded a note of warning about the danger of governments trying to establish artificial yardsticks of cost of operation, a practice which can result only in the people's loss of confidence in private enterprise, responsible for the high standard of living obtaining in America.

NIAGARA PENINSULA BRANCH

J. H. Ings, M.E.I.C. - - *Secretary-Treasurer*
J. L. McDougall, M.E.I.C. - *Branch News Editor*

A dinner meeting of the Niagara Peninsula Branch was held on April 5th, 1945, at the General Brock Hotel, Niagara Falls. The 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.**

The chairman, W. D. Bracken, introduced the guests: Mr. F. R. Cavers and other members of the St. Catharines Town Planning Commission, Mr. S. E. Thomson, chairman of the Niagara Falls Town Planning Commission, Messrs. J. Lawson, C. E. Willox and K. C. Fellowes of the Greater Niagara Post-War Planning Commission, Mayor G. R. Inglis of Niagara Falls and S. Corfield of Stamford Township. The speaker was introduced by M. F. Ker.

Mr. Bunnell defined an engineer as a person who, primarily trained in using the forces of nature for the benefit of mankind, should be able to analyze the techniques of the past and develop new techniques for the world of to-morrow. In the past he has paid too much attention to the technical aspects of his work and not enough to its social results. For example, he has assisted industry to cut down our forests until Canada has become the second largest producer of pulp and paper products in the world. Although much of the land so cleared was not suited for agriculture it has not been reforested. As a result, springs are drying up and the fertile soil is being eroded and carried down the rivers. This is one case where the lack of proper planning is proving harmful to our country.

Since the development of the automobile during the past 40 years has so affected the life of the community, our future planning must be not for the city alone but for the whole region of which it is the centre. The expansion of population must be based on the growth of industry. The location of these industries should be planned on a regional basis having regard to present and future means of transportation and communication. Areas suitable for industry should not be subdivided into building lots. Provision should be made for sufficient parks and playgrounds to serve the increased population.

An Advisory Planning Board was proposed for the region comprising the three municipalities of Niagara Falls, Stamford Township and Chippawa. This Board should be responsible for planning the framework of the whole region. It should select industrial areas, residential districts, the location of schools and recreation facilities.

At the conclusion of his address Mr. Bunnell answered the numerous questions asked by the members. A vote of thanks to the speaker was proposed by W. R. Manock of Fort Erie.

OTTAWA BRANCH

C. G. Biesanthal, Jr. e.i.c. - *Secretary-Treasurer*
R. C. Purser, m.e.i.c. - - - *Branch News Editor*

Illustrating river control structures and similar projects in southeastern Australia, a series of slides with accompanying commentary was shown before the Ottawa Branch at the National Research Council auditorium on the afternoon of April 20th. The speaker was E. D. Shaw, chief engineer of construction, State Rivers and Water Supply Commission, Victoria, Australia. Along wtih H. H. C. Williams, executive engineer of the same organization, Mr. Shaw had been studying methods of construction and types of equipment of water control structures in United States and Canada. These studies are being made on behalf of the Victoria government looking forward in particular to a post-war programme of construction.

After commenting briefly upon the physiography of Australia, the speaker dealt in particular with river control structures on the Murray River and tributaries. Water storage projects were illustrated, as well as methods of water utilization in Victoria, New South Wales, and South Australia. There are large areas thus irrigated, on which various crops are grown.

A crop of particular importance illustrated by the slides was citrus fruits. The water is also of use in places, to help maintain adequate pastures for dairy cattle.

VANCOUVER BRANCH

J. G. D'Aoust, m.e.i.c. - *Secretary-Treasurer*
P. B. Stroyan, m.e.i.c. - *Branch News Editor*

About forty members of the Vancouver Branch received a rare treat on May 2nd, when Brigadier A. T. MacLean, C.B.E., M.C., V.D., addressed the Branch on **Engineering in Warfare**. Brigadier MacLean was formerly chief engineer of the Canadian Army overseas and his intimate knowledge of the operation of the various engineering services made the address particularly enlightening. Introduced by A. Peebles, branch chairman, Brigadier MacLean divided his talk into five main phases, dealing first with the training and preparation of plans for the defence of the British Isles against the expected invasion and the engineering problems encountered. Phenomenal schedules were maintained by the Royal Canadian Engineers in the construction of air strips and by-pass highways for fast movement of defending units. Existing air strips and roads were mined, bridges prepared for demolition, and obstacles of all sorts constructed. In addition a great deal of help was given to the civil authorities in the clearing of debris in bombed cities.

The second phase included the preparation and planning for the landing on the coast of France entailing the construction of floating docks, intensive training in beach landings, demolition of obstacles and use of special equipment. The third phase was the actual invasion and the establishment and consolidation of beach-heads. After this had been accomplished the fourth phase was the tremendous task of the engineers in keeping pace with the requirements of the armies for bridging equipment, highway and railroad repairs, establishment of advance fighter bases, maintenance of equipment, establishment of communications, mine-clearing and innumerable other jobs, culminating in the Seine crossing. Perfect reconnaisance and mapping enabled the engineers to simulate almost exact conditions on an English river where tidal variations and topography of the banks were identical. Intensive training under every condition of weather and tide enabled the bridging crews to become so expert that the Seine crossing was carried out to perfection. The final phase was the approach to and crossing of the Rhine and the transportation of assault boats and landing craft of various types, the repair of roads, the bridging of many smaller streams and canals, and the ever present communication problem combined with multitudinous other jobs to keep the engineer personnel continuously occupied. Perfect reconnaissance and mapping of the Rhine itself made the successful crossing a foregone conclusion and a feat unparalleled in military history.

Major Kenneth Hicks thanked Brigadier MacLean for a most informative presentation.

WINNIPEG BRANCH

A. T. McCormick, m.e.i.c. - *Secretary-Treasurer*
V. W. Dick, m.e.i.c. - - *Branch News Editor*

A joint general meeting of the Winnipeg Branch and the Professional Engineers of Manitoba was held on Thursday, April 15th in Theatre F, University of Manitoba, Broadway. The speaker was J. V. Dillabough, transportation engineer, Canadian National Railways, who spoke on **Transportation in Wartime.**

Mr. Dillabough stressed the vision and enterprise of the Canadian railways which enabled them to handle the record amount of war goods and passengers with less rolling stock than in the last war. To indicate the job accomplished by the railways, the speaker used Dominion government statistics on Canadian steam railways for 1943 to compare the performance during the present war and that of 1914-18. With 24 per cent fewer locomotives in use in 1943 than in 1918, there was an increase of more than 18 per cent in total locomotive mileage.

Although there were 50,636 fewer freight cars in 1943 than in 1918, Mr. Dillabough pointed out that freight car mileage increased 65 per cent, and the average freight car travelled 10,760 miles further. Not only did freight cars travel more than twice as far in 1943 than in 1918, but the carrying capacity per car increased more than nine tons.

Regarding passenger traffic, Mr. Dillabough showed the following increases in 1943 over 1918: Six million more passengers; three billion more passenger miles; total car mileage up 49 per cent; average passenger journey 81 per cent longer, and number of cars per train 58 per cent greater.

Despite the increased traffic, only nine fatal accidents occurred in 1943, equal to one in 6,352,871 passengers. This compared with 32 fatal accidents in 1918, or one in 1,585,340 passengers.

Mr. Dillabough said that the railways had designed and built in their own shops much essential new equipment. On heavy traffic main lines the latest type of signalling systems had been installed to expedite train movements. This was in addition to war equipment produced such as tanks, marine engines, aircraft parts, naval gun barrels and mountings, field artillery carriages, and even a completely equipped armoured train. Besides this, railway shipyards had also built naval and cargo vessels, and repaired many damaged ships.

The meeting was closed by a vote of thanks to the speaker, moved by V. C. Jones, superintendent of C.P.R. Telegraphs, Winnipeg.

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. Standards, 1944; Part II—Nonmetallic Materials Constructional:
Philadelphia, American Society for Testing Materials, c1945. 9½ x 6¼ in.

Cutting Tool Practice:
H. C. Town and D. Potter. London, Paul Elek (Publishers) Ltd., c1945. 8¾ x 5¾ in.

Heaton's Commercial Handbook of Canada (Heaton's Annual); 35th ed:
Toronto, Heaton Publishing Company, 1945. 7¼ x 5¼ in.

Introduction to Electronics:
Ralph G. Hudson. Toronto, Macmillan Company of Canada, 1945. 8¾ x 5¾ in.

Science To-day and To-morrow:
Waldemar Kaempffert. N.Y., Viking Press; Toronto, Macmillan Company of Canada, 1945. 8¼ x 5½ in.

PROCEEDINGS, TRANSACTIONS, ANNUAL REPORTS, ETC.

American Institute of Electrical Engineers:
Year Book, 1945.

American Society of Civil Engineers:
Year Book, 1945.

Canada—Civil Service Commission of Canada:
36th Annual Report, 1944.

Canada—Department of Labour:
Strikes and Lockouts, 1944.

Dominion Fire Prevention Association:
26th Annual Meeting—Proceedings; and

Association of Canadian Fire Marshals:
23rd Annual Conference—Proceedings. (Bound together.)

Iron and Steel Institute:
Journal, Vol. 149, 1944.

Mechanics' Institute of Montreal:
105th Annual Report, 1944.

Nova Scotia Power Commission:
25th Annual Report, 1944.

Wayne University. College of Engineering:
Catalogue Issue, 1945.

Winnipeg (City) Hydro Electric System:
Annual Report, 1944.

REPORTS, TECHNICAL BULLETINS, ETC.

Canada—Department of Mines and Resources—Mines and Geology Branch: Memorandum Series:
No. 89—Physical and Chemical Survey of Coals from Canadian Collieries (Number Four) New Brunswick, Minto Coalfield by E. Swartzman, J. H. H. Nicolls, E. J. Burrough and R. E. Gilmore.

Canada—Department of Mines and Resources—Mines and Geology Branch:
Milling Plants in Canada, Part I; operators of Concentrating Mills Treating Metallic Ores.

Codes of Practice Committee:
British Standard Code of Practice CP (B) 434: Installation of Gas Service Pipes; CP (B) 435: Gas Metering and Consumers Control; CP (B) 436: Gas Installation Pipes; CP (B) 437: Space Heating by Means of Independent Gas Appliances.

Development and Welfare in the West Indies: Bulletin:
No. 13—Housing in the West Indies.

Purdue University—Engineering Experiment Station: Research Series:
No. 94—Engineering Schools and Departments—Research and Extension Activities for the Sessions of 1943-44.

United States—Department of the Interior—Bureau of Mines: Miners' Circular:
52—Accidents from Falls of Rock or Ore in Metal Mines; Metal-Mine Accident-Prevention Course Section 2; 53—Accidents from Hoisting and Haulage in Metal Mines; Metal-Mine Accident-Prevention Course Section 3.

Technical Paper:
671—Analyses of Tennessee Coals (Including Georgia); 676—Energy Requirements and Equilibria in the Dehydration, Hydrolysis, and Decomposition of Magnesium Chloride by K. K. Kelley.

PAMPHLETS

Building Regulations for Reinforced Concrete (ACI 318-41):
American Concrete Institute, 1941.

Brief to the Royal Commission on Co-Operatives:
Canadian Chamber of Commerce, 1945.

Canada—Governor General's Speech:
Opening of Fifth Session, Nineteenth Parliament, January 27, 1945; Prorogation of Fifth Session, Nineteenth Parliament, January 31, 1945. Ottawa, King's Printer, 1945.

Canada and International Civil Aviation:
Ottawa, Wartime Information Board, 1945.

Chance for World Security:
By H. Gordon Skilling. Canadian Affairs, Vol. 2, No. 8, May, 1945.

Family Allowances; a Children's Charter:
Canada, Department of National Health and Welfare, 1945.

Farm Conditions "Down Under":
By J. Gordon Ross. Canadian Chamber of Commerce—Department of Economic Development, 1945.

Homes for Canadians; NHA:
Canada, National Housing Administration, 1945.

Installation Details for Modular Windows:
Modular Service Association, 1945.

Look at Ontario Farming:
S. R. Curry, ed. Tweed News, 1945.

Racial Unity:
By Brooke Claxton. Canada, King's Printer, 1944.

Radio and Electronic Equipment:
Walter-Jimieson, Inc., 1945.

Submission of the North-West Line Elevators Association to the Royal Commission on the Taxation of Co-Operatives:
North-West Line Elevators Association, 1945.

War Appropriation—National Defence:
By D. C. Abbott. Canada, King's Printer, 1945.

BOOK NOTES

Prepared by the Library of the Engineering Institute of Canada

ABC OF PHYSICS

By Jerome S. Meyer. Longmans, Green & Co., 215 Victoria St., Toronto 1, 1944. 346 pp., illus., cloth, $4.50.

To know physics thoroughly requires far more time and concentrated study than the average man can afford. However, the vast majority of people today are eager and anxious to know a little something about the science which is so vitally important to them in their every day lives. It is for them that this book was written.

The author is a layman who wrote the book for laymen in the language, not of the physicist, but of the layman. This means that all details and technicalities so important to the physicist are omitted and the book takes the form of a physics guide rather than a physics text book.

In these pages the reader will find, in addition to a discussion of the principles, theories and experimental facts of physics, a very wide range of their direct application. Though a detailed analysis is nearly always missing, the fundamental principles which are used to give us our modern conveniences are pictured in a clear and interesting manner.

CARE AND USE OF HAND TOOLS

By Raymond R. Toliver; Edited by William Lewis; Illustrated by L. O. Angell. John Wiley & Sons, Inc., 440-4th Ave., New York 16, N.Y., 1944. 93 p., illus., cloth, $1.25.

Much of the material in this book was prepared originally for the training of beginning employees in a great B29 Superfortress aeroplane plant. The information was not prepared to meet any theoretical need, but was written with reference to actual shop operations and designed to help employees become more useful to an industrial organization.

The entire book, however, has been rewritten in more general form, in order to make it equally useful for both pre-production industrial training classes and shop classes in high schools and manual training institutions.

It is an elementary manual, describing and illustrating the handling of common tools used in machine shops, and is therefore suitable for beginning mechanics who will work in small shops as well as in large plants, and suitable for peacetime training as well as wartime industrial classes.

FLEXIBLE SHAFT HANDBOOK; 2d. ed.

S. S. White, Industrial Division, 10 East 40th Street, New York 16, N.Y., 1944. 256 pp., illus., leather, apply.

This second edition of the handbook brings information and engineering data about flexible shafts up to date. It covers the progress and the many developments that have been made since the first edition was issued. The book is divided into three parts:—Part I—Flexible shafts for power drives; Part II—Flexible shafts for remote control; Part III—Connecting Flexible shafts. It covers new applications numerous in aviation, automotive, radio, electronic, machinery, and many other fields, as well as the applications in planes, tanks, ordnance, naval, signal corps, and other military equipment.

HOW YOU CAN GET A BETTER JOB

By Willard K. Lasher and Edward A. Richards. American Technical Society, Drexel Avenue at 58th St., Chicago. 1945. 206 pp., illus., cloth, $1.50.

The book is written for those preparing for or seeking employment or for those who are desiring promotion not by quitting their job, but by earning the promotion. It emphasizes that rewards for work are still, in the long run, based on ability, integrity, tact and earnest endeavour and not, as so many claim, through "chiseling", and "pull". It is a sane presentation of the personal factors that make for success and promotion in a job.

METALLURGICAL EXPERIMENTS (Non-ferrous Metals, Iron and Steel)

By F. Johnson. Paul Elek (Publishers) Ltd., Africa House, Kingsway, London W.C.2, 1944. 98 pp., tables, paper, 5s.

The experiments described in this booklet are intended to provide a form of instruction to supplement that given in the lecture room and to furnish the student with self-obtained evidence of the chemical reactions, physical changes, and variety of properties upon which the manufacture and applications of metals and alloys depend. The experiments detailed herein are concerned with the refining, melting, working, and uses of metals and alloys. The series are representative and will provide an adequate range for students in their early acquaintanceship with the subject.

OCCUPATIONAL ACCIDENT PREVENTION

By Harry H. Judson and James M. Brown. John Wiley & Sons, Inc., 440-4th Avenue, New York 16, N.Y., 1944. 234 pp., cloth, [illegible].

This book is a text book suitable as a convenient and complete reference manual in industrial safety engineering. Every effort has been made to make the book complete and at the same time to eliminate all unnecessary detail. It is planned for the supervisory employee as well as for the safety director. It is not so much about safety itself as about the fundamentals in plant operation for bringing about accident prevention. Briefly, this book is intended to show how to attain freedom from accidents. The authors have attempted to record most of the means by which accidents have been controlled throughout industry in the past. For the solution of specific problems as they arise the reader is referred to the Safe Practices Pamphlets of the National Safety Council, the safety codes of the American Standards Association, and the many excellent pamphlets prepared by the various branches of the United States Government.

WHAT IS VOCATIONAL EDUCATION; a Series of Discourses on Various Aspects of Vocational Education

By George H. Fern. American Technical Society, Drexel Avenue at 58th Street, Chicago, 1944. 159 pp., illus., cloth, $2.50.

This book is presented with the hope that the experiences of the past, enumerated in it, may help the public schools—vocational and general educators alike—to plan together for the future of education. It is an attempt to summarize and clarify the purposes of vocational education. It explains how the schools met the emergency needs of the people in wartime, and how they must meet the new needs of a nation returning to peace, and the readjustment problems which inevitably follow wars.

WOOD AND CHARCOAL AS FUEL FOR VEHICLES: 3d-ed.

By R. Ruedy. National Research Council of Canada, Ottawa, 1944. 76 pp., illus., paper, $1.00. (N.R.C. No. 1187)

"Wood and charcoal as fuel for vehicles" was first issued in 1939. The original contained a review of the available world literature on this subject and covered the advances in the principal European countries.

The second edition was issued in 1942, by which time the number of producer gas vehicles had increased considerably in several countries. Supplementing the review of the literature where sections on the manufacture of producer gas, a description of the principal types of gas producers, producers for wood and charcoal for use on vehicles, producers on rail, buses and ships, and farm tractors. A comprehensive bibliography completed the report.

In this, the third edition, the bibliography has been omitted. It is known that many articles on this subject appeared in recent years in various countries, and the previous bibliography has therefore become inadequate; but as many of the required journals are not at present available for abstracting, it has been decided to defer the revision of the bibliography until more complete references become available. Throughout the text, however, sources of information have been acknowledged by quoting the names of articles and books.

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 1944 INCLUDING TENTATIVE STANDARDS (a Triennial Publication)

Part 1. Metals. 2047 pp.
Part 2. Nonmetallic Materials—Constructional, 1649 pp.
Part 3. Nonmetallic Materials—General. 2202 pp.

American Society for Testing Materials, 260 S. Broad St., Philadelphia, 1944-1945. Illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $10. per volume.

This new edition of A.S.T.M. Standards contains 1235 specifications and standard methods, including both formal and tentative ones. It also includes the emergency standards and alternate provisions adopted because of wartime conditions. The work appears in three volumes: Part 1, Ferrous and Non-ferrous Metals; Part 2, Constructional Nonmetallic Materials; Part 3, General Nonmetallic Materials. Each part has an index and may be purchased separately.

AEROSPHERE, 1943, including Modern Aircraft, Modern Aircraft Engines, Aircraft Statistics, Buyer's Guide, edited by G. D. Angle and others.

Aerosphere, Inc., 370 Lexington Ave., New York, 1944. Paged in Sections, illus., diagrs., tables, 12 x 8½ in., cloth, $15.00.

"Aerosphere" provides brief descriptions of the aircraft and aircraft engines currently being built throughout the world, together with statistical information on these industries and a buyer's guide. The arrangement is by countries, then by manufacturers. The specifications, construction, equipment, instruments, performance and engine for each model are stated, usually with a photograph of the plane or drawing of the engine.

AIRCRAFT ARMAMENT

By L. Bruchiss, edited by G. D. Angle. Aerosphere, Inc., 370 Lexington Ave., New York, 1945. 224 pp., illus., diagrs., charts, tables, 12 x 8½ in., cloth, $6.00.

Detailed descriptions are given of the bombs, machine guns and cannon with which aircraft of various countries are armed. Separate chapters are devoted to armor protection, anti-aircraft weapons and self-propelled ammunition and bombs, including rockets and jet-propelled units. Brief consideration is given to historical development and to the future possibilities of aircraft armament. A glossary is included.

BUILDERS OF THE BRIDGE, the Story of John Roebling and His Son

By D. B. Steinman. Harcourt, Brace and Company, New York, 1945. 457 pp., illus., 8¼ x 5¼ in., cloth, $3.50.

This interesting contribution to the history of bridge building covers the careers of two great engineers of the nineteenth century. Emigrating to America in 1831, the elder Roebling soon began his engineering life as a railroad surveyor. This was followed by the manufacture of wire rope, for the first time in America. Soon, however, he turned to suspension bridges, the field in which he and his son became famous. Dr. Steinman describes the bridges built at Pittsburgh, Niagara and Cincinnati, and finally the construction of the Brooklyn bridge. This last is dealt with in detail with great skill. The story is a dramatic one, of interest to laymen, as well as engineers.

BUILDING INSULATION

By P. D. Close. 2 ed. American Technical Society, Chicago, Ill., 1945. 328 pp., illus., diagrs., charts, maps, tables, 8½ x 5½ in., cloth, $3.50.

The major part of this book is devoted to heat insulation for buildings. In addition to the comprehensive information on the insulation itself and its characteristics, there are chapters on the methods of application and on the economics of insulation. Other chapters cover the topics of piping and duct insulation, sound insulation, machinery isolation and architectural acoustics. A useful feature is the very full list of commercial insulating materials arranged alphabetically by trade name.

GAS TURBINES and JET PROPULSION for AIRCRAFT

By G. G. Smith. Aerosphere, 370 Lexington Ave., New York, 1944. 123 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, $3.00.

The history of the development of gas turbine prime movers employing jet propulsion is concisely presented with considerable technical detail. Examples of gas turbine units driving orthodox airscrews are included, and steam turbines are briefly reviewed. The work has been generally revised, and three new chapters have been added on turbine-compressor units, jet vs. airscrew, and boundary layer control. An interesting feature is the discussion of the future possibilities of the gas turbine power unit in the "flying wing" type of aircraft.

HEATING, VENTILATING, AIR CONDITIONING GUIDE, Vol. 23, 1945

Technical Data Section together with a Manufacturers' Catalog Data Section, also Roll of Membership and Complete Indexes.

American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York, 1945. 1152 pp., also 64 pp. membership list, illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $5.00.

This edition follows the pattern of previous ones, but a change in format has made an opportunity for general revision and an increase in the amount of information. Many chapters have been rewritten wholly or in part, and new data added. The technical section provides all the data ordinarily needed by engineers and architects, thoroughly indexed for quick reference.

The catalog section contains information on the products of over two hundred manufacturers, with an index.

MANAGEMENT OF INSPECTION AND QUALITY CONTROL

By J. M. Juran. Harper & Brothers, New York and London, 1945. 233 pp., 8¾ x 5¼ in., cloth, $3.00.

The subject matter of this book divides broadly into four categories: the performance of the actual inspection work, including problems of quality specifications, measurement, accuracy, sampling, etc.; the use of inspection data; the internal organization of the inspection department and its place in the plant organization; and the general philosophy of inspection and quality control, with the necessary management controls for effective co-ordination.

MANUAL OF TRAFFIC ENGINEERING STUDIES, 1945

Traffic and Transportation Division, National Conservation Bureau, division of Association of Casualty and Surety Executives, New York. 118 pp., illus., diagrs., charts, maps, tables, 11 x 8¼ in., cloth, $2.00.

The Manual is a revised and enlarged edition of the Traffic Survey Manual published by the National Conservation Bureau in 1937. It is designed especially to aid those communities of 25,000 to 250,000 population that are interested in maintaining adequate, safe transportation on their streets. The methods, forms and procedures used in traffic studies and surveys are described in twenty studies covering such matters as accidents, route and parking congestion, pedestrian accidents, hazardous intersections, etc.

MECHANICAL AND ELECTRICAL EQUIPMENT FOR BUILDINGS

By C. M. Gay and C. De van Fawcett. 2 ed. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 453 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $5.00.

The coverage of this manual is indicated by the headings of the five sections: water supply; plumbing and drainage; heating and air conditioning; electrical equipment; and acoustics. The purpose of the book is to acquaint architects, students and building managers with the basic theories and applications concerned with building equipment, rather than to provide a handbook for complicated design and specifications. This edition has been considerably rewritten to conform with modern practice and the latest recommendations and provisions of the pertinent codes and standards.

NEW ARCHITECTURE AND CITY PLANNING, a Symposium, edited by P. Zucker.

Philosophical Library, 15 East 40th St., New York, 1944. 694 pp., illus., diagrs., tables, 9 x 6 in., cloth, $10.00.

This symposium represents realistic suggestions for the future of architecture and city planning by leading American authorities. The several sections deal respectively with specific building types, new materials and new construction methods, housing, city and regional planning, monumentality in architecture, and the education of citizen interest in the foregoing topics. The social requirements and implications of the various problems are brought out as well as the purely technical aspects.

PHOTOGRAPHIC SURVEYING

By B. B. Talley and P. H. Robbins. Pitman Publishing Corp., New York and Chicago, 1945. 225 pp., illus., diagrs., charts, maps, tables, 9¼ x 6 in., cloth, $3.00.

Intended as a textbook for personal or classroom use, this book covers a wide field. The first thirteen chapters deal with the fundamentals of photographic surveying, photographic equipment and its use, the interpretation of aerial photographs and the description and use of all special instruments and methods. The last chapter demonstrates the many applications of the technique in the fields of civil engineering, geology, archeology, forestry, etc.

PHOTOMICROGRAPHY, an Introduction to Photomicrography with the Microscope. 14th ed.

Eastman Kodak Co., Rochester, New York, 1944. 174 pp., illus., diagrs., charts, tables, 8¾ x 5¾ in., cloth, $2.00.

Beginning with description of the necessary apparatus and general optical principles, this small book surveys the process of photography through a microscope in considerable detail. The special techniques for motion photomicrography and colour photomicrography are explained, and a selected bibliography is appended.

REFRIGERATION AND AIR CONDITIONING ENGINEERING

By B. F. Raber and F. W. Hutchison. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 291 pp., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.00.

In this volume, refrigeration and air conditioning are treated as sciences rather than as arts. The treatment is rigorous and restricted to fundamental principles and rational procedures. Descriptive material and performance data on actual equipment are omitted. Emphasis is placed on graphical solutions, and time-saving charts are numerous. The book is designed to be a reference book for practising engineers, as well as a text for engineering students.

REPORT ON PROPOSED RAILROAD GRADE CROSSING ELIMINATION AND TERMINAL IMPROVEMENT FOR NEW ORLEANS, LOUISIANA, September 5, 1944. 2 Vols.

Godet and Heft, Consulting Engineers, New Orleans. Vol. 1, 102 pp.; Vol. 2, Appendices A-D, 135 pp., many plates, tables, diagrs., charts, 11¼ x 8½ in., fabrikoid, apply.

In preparation for a postwar programme of grade crossing elimination and union passenger terminals in New Orleans, the firm of Godet and Heft has made studies of possible solutions of the problem which are reported in these volumes. Four alternative programmes are presented, with plans and detailed cost studies, and complete drawings.

SPLICING WIRE AND FIBRE ROPE

By R. Graumont and J. Hensel. Cornell Maritime Press, New York, 1945. Illus., diagrs., tables, 10 x 7 in., cloth, $2.00.

A very specialized skill is clearly explained and demonstrated in text and pictures for the benefit of all those who have frequent occasion to handle wire or fibre rope. The rigging of blocks and tackles is included, and a complete glossary of rope terms concludes the work.

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

CHEMICAL ENGINEER. Young man about 25 years of age, preferably single because of travelling involved, and with experience of a year or more is required to become a sales engineer for an engineering firm in Montreal engaged in installation of acid resistant linings for pulp and paper machinery. The starting salary would be in the neighbourhood of $200. a month. Apply to Box No. 2970-V.

CIVIL

CIVIL ENGINEER is required for supervising the location and construction of mining roads in the Lake St. John area of Quebec. The salary will be approximately $3000. a year depending on qualifications. Apply to Box No. 2915-V.

CIVIL ENGINEER, recent graduate, is required by a construction company to start in their filing department and draughting room with the object of becoming thoroughly qualified for work in the field. Headquarters of this firm is in Montreal and the starting salary would be $175. a month. Apply to Box No. 2916-V.

CIVIL ENGINEER to be trained from scratch, if necessary, as assistant to municipal engineer of township in southern Ontario. Starting salary $165. a month. Apply to Box No. 2978-V.

CIVIL ENGINEER. A young graduate with some experience in construction work is required to assist in extension of airport facilities near Montreal. Salary open according to experience. Apply to Box No. 2991-V.

CIVIL ENGINEER is required for design detail and sales work with a firm engaged in the production of structural steel. Candidates should be bilingual. This position is in Montreal at a salary which will be discussed with the candidate. Apply to Box No. 2921-V.

CIVIL ENGINEER, graduate, with land surveyor's certificate between the ages of 25 and 30 is required to work with a firm of consulting engineers and land surveyors in south-eastern Ontario with eventual prospect of partnership. Starting salary would be $200 a month. Apply to Box No. 2980-V.

GRADUATE ENGINEER is required to take over management of a plant engaged in the production of lime in south-eastern Ontario. Candidates should be young men with some experience in construction and in organizing men and handling equipment. Good prospects for man with ideas and initiative to make this a really worthwhile project. This position is worth approximately $300 a month Apply to Box No. 2922-V.

CIVIL ENGINEER is required by a railway company in Montreal to act as an expert on structural steel and concrete as applied to buildings. This position is worth $3000. a year. Apply to Box No. 2951-V.

CIVIL ENGINEER is required to act as assistant engineer for a construction company in Montreal. Candidates should be recent graduates and the work will involve design and draughting of operational plans and plant layouts. Starting salary will be approximately $200. a month. Apply to Box No. 2959-V.

CIVIL ENGINEERS. Several graduate engineers, either civil or mechanical between the ages of 22 and 30 are required to start as structural steel draughtsmen with the opportunity of becoming structural steel designers and sales engineers. The starting salary varies with experience between $185. and $250 a month. Apply to Box No. 2961-V.

GRADUATE ENGINEER between 30-40 years of age is required to act as assistant professor in a university in central Canada, to supervise draughting in junior years and to do some lecturing on varied subjects with the department of civil engineering. This position would be worth approximately $3000 a year. Apply to Box No. 2976-V.

ELECTRICAL

GRADUATE ENGINEER, electrical, mechanical or civil with two to three years' experience is required by a firm of specialists in scientific illumination to be trained to act as sales engineer for this firm. The training period will be spent in Toronto at $180. a month. Apply to Box No. 2905-V.

ELECTRICAL ENGINEER is required as an understudy for the electrical superintendent of a manufacturing company in Montreal. Apply to Box No. 2906-V.

ELECTRICAL ENGINEER, graduate, not more than 30 years old, to start on draughting board with good prospects to work into good position with a construction company in Montreal. Salary to be discussed with candidate. Apply to Box No. 2924-V.

ELECTRICAL ENGINEER, university graduate with general maintenance experience of not less than three years in any branch of sound engineering is required for the post of electrical maintenance supervisor. Salary for this position will be in the neighbourhood of $2400. a year and the location will be in Ottawa. Apply to Box No. 2949-V.

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.

MECHANICAL

MECHANICAL DRAUGHTSMEN, university graduates in mechanical or civil engineering are required for design work in connection with boilers, pressure vessels, structural steel. material handling equipment. This position is in the Winnipeg area and the salary is open according to the experience of the candidate. Apply to Box No. 2903-V.

MECHANICAL ENGINEER is required by a milling company for maintenance and operation of grain elevators. This position is in Saskatchewan and the salary is open according to the qualifications of the applicant. Apply to Box No. 2914-V.

MECHANICAL ENGINEER is required for work on machine design and plant layout at Shawinigan Falls, Que., at a salary of approximately $225. a month. Apply to Box No. 2920-V.

MECHANICAL ENGINEER is required to become chief engineer of a large manufacturing concern. Experience should include considerable maintenance and administrative work and age should not be over 35. Salary for this position is approximately $5000. a year. Apply to Box No. 2926-V.

SEVERAL GRADUATES in either mechanical or civil engineering are required for designing, estimating and planning projects in a large pulp and paper manufacturing plant. Some pulp and paper mill experience is desirable but not essential and experience should include some work in pump and piping installations, mechanical power installations, conveying problems, machinery layout and design, design and construction of reinforced concrete, boiler plant design, etc. This position is in British Columbia and the salary would be between $250 and $290 a month. Apply to Box No. 2952-V.

MECHANICAL ENGINEER, preferably with some experience in the pulp and paper industry is required for draughting and design work with a pulp and paper company in the Lake St. John district at a salary of approximately $300. a month. Apply to Box No. 2941-V.

TWO SENIOR DRAUGHTSMEN with some knowledge of aircraft to work on modifications and repairs of aircraft. This company is situated in the Montreal area. Salary would be in accordance with the qualifications of the applicant. Apply to Box No. 2948-V.

MECHANICAL ENGINEER with tool and die experience and extensive background in intricate work such as small dies, instrument fitting, gauges, etc., and some experience in installation work covering motors, pumps, tanks, etc., is required to act as mechanical design and maintenance supervisor of a motion picture laboratory. This position will be in Ottawa at a salary of approximately $3000. a year. Apply to Box No. 2950-V.

MECHANICAL ENGINEER, graduate, preferably with at least 3 years experience as junior mechanical engineer is required to work in the Drummondville plant of a large manufacturing company. Must be bilingual and will be responsible for executing production schedules, maintaining quality standards and maintenance of equipment. Age preferably between 23-27 years. Salary to be discussed with applicant. Apply to Box No. 2756-V.

MECHANICAL ENGINEER, young man, bilingual, is required to act as assistant to the chief engineer of a firm engaged in the manufacture of soft drinks. He will be required to do most of the active mechanical engineering of the plant and must be willing to work at times in overalls but be able to represent the company in New York and Ontario, etc. This position is in Montreal at a salary in the neighbourhood of $75. a week. Apply to Box No. 2960-V.

MECHANICAL ENGINEER with some experience in factory operation and routine, including machine shop and bench assembly operations, and if possible, some experience in the manufacture of wire and cable, telephone and switchboard assembly work is required by a firm engaged in this line in south-eastern Ontario. This position would entail establishing production standards through time and motion study, analysis of shop operations, etc. Candidates should be under 35 years of age and can expect a salary of between $175. and $250. a month depending on their experience. Apply to Box No. 2967-V.

MECHANICAL ENGINEERS. Several young graduates are required for work involving sales, service and design of mining machinery and pulp and paper equipment. Headquarters of this firm is in Montreal and these positions might be there or in one of their branches scattered across Canada. Salary would be open according to experience. Apply to Box No. 2975-V.

MECHANICAL ENGINEER, preferably with some metallurgical experience is required to start as a draughtsman prior to becoming sales engineer as understudy to a $10,000. a year position with a small profit-sharing organization in Toronto. This position would be worth approximately $250. a month to start. Apply to Box No. 2978-V.

MISCELLANEOUS

TWO YOUNG GRADUATE ENGINEERS with four or five years' experience are required to be trained in Canada for a couple of years and then to work in Europe. These positions are with a large manufacturing firm with headquarters in Toronto and will be worth about $4000. a year. Apply to Box No. 2927-V.

SALES ENGINEER with some technical training, not necessarily a graduate, preferably bilingual, is required by a company engaged in sheet metal work. This position is in Montreal and the starting salary would be about $175. a month. Apply to Box No. 2930-V.

DESIGNING ENGINEER with pulp and paper mill experience is required for a mill in Newfoundland. This position is worth between $250. and $350. a month depending on qualifications. Apply to Box No. 2937-V.

YOUNG GRADUATE ENGINEER is required to give quotations on temperature and heat control equipment. Eventually to become salesman for a manufacturer's agent in Montreal. This position is worth between $150. and $200. a month. Apply to Box No. 2938-V.

GRADUATE ENGINEER with some experience in setting up standards for material control is required to work in Montreal with a company engaged in the manufacture of metal containers at a salary of between $200. and $250. a month. Apply to Box No. 2940-V.

TWO WELDING APPRENTICES, young graduates, are required to work for a firm engaged in specialized welding jobs in the Montreal area. These men will start in the shop for a period of about six months and then proceed through a period in the draughting room into the field as sales engineers with good prospects for promotion for the right men. The salary during the training period will be the equivalent of the current shop rates. Apply to Box No. 2946-V.

SEVERAL ENGINEERS are required by a firm engaged in the manufacture of pressure vessels, storage tanks, steel plate work of all kinds. Candidates should be between 25 and 35 years old with general engineering background and ability to handle people. These positions will be in Toronto or Montreal at a salary of between $150 and $300 a month depending on experience. Apply to Box No. 3000-V.

GRADUATE ENGINEERS either civil or mechanical are required by a bridge company in the Montreal area for draughting and design work in connection with structural steel and mechanical equipment. An electrical engineer is also required for work in connection with wiring diagrams. These positions would be worth approximately $225. a month. Apply to Box No. 2971-V.

DRAUGHTSMAN is required by a consulting engineer in Montreal to work on plans involving heating and ventilating and mechanical layout for hospitals under construction. Salary is open according to the qualifications of the candidate. Apply to Box No. 2974-V.

CIVIL ENGINEER, recent graduate with emphasis on candidate's attitude and character rather than experience is required by a consulting engineer in Montreal at a salary varying between $175. and $225. a month depending on qualifications. Apply to Box No. 2977-V.

THE CIVIL SERVICE COMMISSION is on the lookout for engineers for four grades, 1, 2, 3 and 4 at salaries ranging from $1800. to $4200. a year; Further details and application forms will be sent on request.

THE DEPARTMENT OF PUBLIC WORKS in Ottawa is looking for two engineers, Grade 1, for public works reconstruction at a salary range of $1800. to $2400. a year.

THE DEPARTMENT OF MINES AND RESOURCES is contemplating the establishment of a number of positions, including surveys engineers, Grade 1, 2 and 3 at salaries ranging from $1800. to $3200. a year; associate geologists and geologists at salaries ranging from $2200. to $4600. a year.

There are also vacancies for senior Map draughtsmen and Mines engineers, Grade 1, at salaries between $1800. and $2160. a year. Forestry engineers, Grade 1, Hydrographers, Grade 1 and a Water and Power engineer are also required in this same salary range. A Forest Products engineer, Grade 3 is required in Vancouver at a salary of between $2820. and $3240. a year.

PROSPECTS OF BUSINESS WITH INDIA

A member of the Institute, located in the United States, has offered to establish contacts with the India Industrial Mission which is about to visit the United States, for any of the younger members of the Institute interested in possible positions in India, or for members who are in such positions where they may wish to establish business relations with India. Write Headquarters.

SITUATIONS WANTED

ELECTRICAL ENGINEER, M.E.I.C., age 38, B.Sc. McGill. Widespread experience on electrical maintenance, radio and telephone engineering. Five years with the R.C.A.F. in the aeronautical engineering branch specializing on electrical work. Immediate experience before joining the R.C.A.F. was four years on electrical maintenance in paper mills, including experience with Harland and General Electric drives. Interested in maintenance, development or layout design of electrical equipment. Not available until release from the R.C.A.F. but wishes to make contacts for a post-war position. Apply to Box No. 12-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., with 18 years' experience in iron industry; machine tools, steel cabinets, conveyors, etc., light metal and food processing industry, has held executive positions in charge of production, industrial engineering, designing, buying, selling, financing. An expert in cost accounting and lighting, a man with good ideas, tact, initiative and sound technical judgment, available immediately. Age 41, married, Canadian bilingual. Apply to Box No. 1730-W.

CIVIL ENGINEER desires part-time employment. Experience in design, estimating, draughting, supervising work, field engineer in municipal and highway works, also in heating, air-conditioning and mining. Owns a car. Apply to Box No. 1859-W.

ENGINEER, M.E.I.C., R.P.E.(Ont.), presently employed as assistant engineer and chief draughtsman. Desires new connection due to contemplated staff reduction in a war industry. Extensive experience in structural steel and plate fabrication miscellaneous builders' iron work and reinforced concrete as engineer and draughtsman, estimating and sales. Apply to Box No. 2208-W.

CIVIL ENGINEER, M.E.I.C., R.P.E.(Ont.), B.A.Sc., Toronto. Resident for past 12 years in U.S., New York, desires to return permanently to Canada. Thirty-two years' experience on design and construction of harbour works, piers, dry docks, quay walls, cofferdams, foundations, steel and concrete buildings. Specialist steel sheet piling, railway location and construction. Public utility appraisals, industrial engineering, sales engineering and promotional work including export sales, journalistic and advertising work. Foreign experience in China, West Indies, Alaska. Good organizer and executive. World War I veteran. Seeking administrative or supervisory opening or sound sales or business opening. Willing to travel. Apply to box No. 2476-W.

MECHANICAL ENGINEER, 41 with 17 years' experience in machine shop, production of precision parts, internal combustion engines, tool design, seeks responsible position; will consider association with reputable consulting engineers. Apply to Box No. 2480-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., age 35, married, 6 years general office experience, 4½ years on maintenance, inspection and construction in oil refinery, 3 years supervising construction in tropics, 1½ years on structural steel and reinforced concrete design, piping and plant layouts. Desires field position, preferably on construction work. Location immaterial. Registered with W.B.T.P. and available May 1st. Apply to Box No. 2481-W.

GRADUATE CIVIL ENGINEER, University of Manitoba, age 33. During past six years have held technical and administrative positions in various industries. Would like sales opening or business proposition where ability to approach business or government officials, initiative and organizing ability, and a liking of people would be of value. Presently in Ontario, would consider locating in West. Available on short notice, registered with W.B.T.P. Apply to Box No. 2500-V.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., with 16 years experience in Canada and abroad in tool machines, tool design, general machine design, shop and industrial engineering and as chief industrial engineer in plant employing 6000 men. At present chief engineer with large aircraft manufacturing company in Montreal. Successful organizer, age 40, available shortly, Apply to Box No. 2502-W.

CIVIL AND MECHANICAL ENGINEER, M.E.I.C., R.P.E. (Que.) B.A.Sc. (honours) Toronto, desires administrative position with responsibility in an expanding and progressive industry. Applicant has ten years engineering and supervisory experience—four years in design, estimating, fabricating and erection of steel plate work and six years in plant layout and design, mechanical equipment design and installation, and administration of engineering, maintenance and construction department of a large plant. Excellent references. Available under the regulations of the W.B.T.P. Apply to Box No. 2503-W.

Industrial News

Industrial development—new products—changes in personnel—special events—trade literature

DECEASED

Paul Judson Myler, director and former chairman of the Canadian Westinghouse Co. Ltd., died on April 20th, 1945, after a brief illness.

Mr. Myler entered the employ of the Westinghouse Air Brake Company at Pittsburgh in 1886. In 1894 he was appointed assistant auditor of the Westinghouse Air Brake Company and in 1896 he was sent to Hamilton, Ont., to become secretary of their newly formed Canadian company, known as the Westinghouse Manufacturing Company Limited. In 1898 he became general manager of this enterprise.

In 1903 the Westinghouse Electric & Manufacturing Co. of Pittsburgh also entered the Canadian field and joined forces with the Westinghouse Air Brake Company in organizing the company known as the Canadian Westinghouse Company, Limited. Upon the incorporation of this company, Mr. Myler was elected vice-president. In 1917 he became president of the company and was elected chairman of the board in 1934, which office he retained for the ensuing ten years until his retirement from active service.

NEW PRESIDENT

Ross H. McMaster, president of The Steel Company of Canada, Limited, since 1926 and a director since 1914, was appointed chairman of the board of the company at a meeting of its board of directors recently held in Hamilton. H. G. Hilton, hitherto executive vice-president was appointed president of the company.

Mr. Hilton entered his career as a steel maker with Pickands Mather & Company at their blast furnace plant in Chicago and held other blast furnace operating positions in the United States before returning to Canada in 1919 to become assistant superintendent of the blast furnaces for The Steel Company of Canada in Hamilton.

His rise with the company has been rapid, in succession becoming superintendent of blast furnaces, assistant works manager, Hamilton works, and in 1934 works manager, Hamilton works. Eight years ago Mr. Hilton was appointed vice-president of the company, appointed a director in 1941 and in 1943 was appointed executive vice-president. He now becomes president of the company.

AUTOMATIC HEATING COURSE

An event of prime significance to the heating industry has recently been announced by W. H. Evans, general manager, Minneapolis - Honeywell Regulator Co. Ltd. This was the opening, after more than a year of careful preparation, of what promises to be a nation-wide school for virtually every individual associated with the automatic heating industry.

This "school", which is offered without charge, is open to dealers, wholesalers, manufacturers, vocational schools, electricians, steamfitters, sheet metal workers and any others interested in heating installations, and will be held in all sections of Canada where Company branches are maintained, or where a sufficient number of people indicate a desire to enroll. It was anticipated in the planning of the course that it will also contribute to the rehabilitation of those men of the armed forces who, from prior experience, or by choice, want to find jobs in some phase of the heating industry.

The primary purpose of the programme is to teach the application of automatic controls and their installation and maintenance, in connection with all types of heating systems using all kinds of fuel. The information to be covered has been divided into nineteen subjects with plans to cover several phases in each meeting. Subjects to be discussed are: control identification, circuits, thermostats, thermostat installation, limit controls, relays, controls for oil burners, summer-winter systems, oil burner systems, gas burner control systems, stoker systems, hand-fired systems, unit heater systems, zone controls, "Weatherstat" systems, "Moduflow", and installation helps and service tips.

Prepared by Honeywell technicians in co-operation with a company specializing in visual education, the complete course extends for four 2½ hour meetings. More than 800 slides, of installations, charts and diagrams of circuits, wiring, piping, etc., are used, while simple but complete lectures, by company sales-engineers who have been specially trained for the purpose, fill in the details.

In commenting on the necessity for the course, Mr. Evans said, "We firmly believe that unless the heating industry takes steps to build up a strong organization of trained help, it will fall by the wayside in the rush of business after the war. We also believe that with trained help, the heating industry will assume a new importance in the nation's economy and will provide more jobs at higher incomes for more people than ever before. Certainly the opportunity is there, and we hope this school will help every member of every branch of the industry to attain it." (See Minneapolis-Honeywell advertisement in this issue.)

PUMPS

Darling Bros. Limited, Montreal, Que., have recently issued bulletin 40C, describing an automatic electric vertical condensation return pump for which unusually high efficiencies are claimed with reduced motor sizes and lower operating costs. Included is a typical specification form and a table of dimensions, capacities and ratings, together with related engineering drawings.

RECENT APPOINTMENT

As part of a plan to render an enlarged engineering service to their customers, assisting also in bringing many new and improved products developed during the war, into peacetime applications, J. L. McKay-Clements, general manager, Canada Wire & Cable Co. Ltd., has announced the appointment of Philip J. Croft to their engineering staff.

Mr. Croft was born and educated in England, and came to Canada in 1920 to join the staff of the Canadian Westinghouse Co. Ltd., in their switchgear design and layout departments. In 1927 he moved to Montreal to join the engineering department of the Power Corporation of Canada Limited, with which organization, as chief electrical engineer, he was placed in charge of the electrical features of design of the many power plants, sub-stations and transmission extensions undertaken by that company in various parts of Canada.

Ross H. McMaster

H. G. Hilton

Philip J. Croft

THE ENGINEERING JOURNAL

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* * *

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CONTENTS

COVER PICTURE

Behind the scenes of Canada's industrial war effort in the laboratories of the National Research Council in Ottawa, scientists are playing their important part in developing and improving war weapons. The cover picture shows a chemist conducting an experiment in the anti-gas laboratory. (*National Film Board*)

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EVALUATION OF AEROPLANE METALS

J. A. VAN DEN BROEK, M.E.I.C.
Professor of Engineering Mechanics, University of Michigan, Ann Arbor, Michigan

This paper will be presented at the Sixtieth Annual General and Professional Meeting of The Engineering Institute of Canada, next February, in Montreal, as part of an address on Evaluation of Light Metal Alloys. Either oral discussion at the meeting or written discussion is invited

SYNOPSIS

The material herein presented was gathered as part of a research project for the Bureau of Aeronautics (Structures Branch) of the U.S. Navy on "Evaluation of High Strength Aluminum Alloys". The Bureau has released this material for independent publication.[1]

In this paper the physical constants determined are limited to elastic limit, yield stress, ultimate stress, modulus of elasticity, weight and ductility. The materials tested are primarily the new aluminum alloys 75 ST, R 301 T, and R 303 T. To offer an immediate basis of comparison for aluminum alloys, the aluminum alloy at present in common use, namely 24 ST, was also tested. To extend the scope of the project still further, a few tests on magnesium alloy and stainless steel were included.

In an aeroplane, roughly one half of the material is subject to tension stresses, the other half to compression stresses. The compression stresses are generally critical. The ultimate strength of metal in compression may be obtained, but is generally meaningless, since structures subject to compressive loads fail by buckling and not by rupture.

Figures 18 and 19 represent the best graphical representation we have been able to devise of the comparative compressive strength values of various aeroplane metals. On these figures the physical constants of elastic limit, yield stress, modulus and weight are all reduced to a common standard. Significant as we believe these figures are, a note of warning should be sounded. One of the most important physical constants, namely ductility, is not evaluated on Figs. 18 and 19. Thus the apparent superiority of magnesium in Figs. 18 and 19, in the long column range, may have to be discounted, possibly to the extent of eliminating it completely from consideration.

TESTING PROCEDURE

All tests were conducted in the Materials Testing Laboratory of the University of Michigan. The machines used were a 50,000 lb. capacity Riehle testing machine and an Amsler hydraulic testing machine. The strain gauges used were Huggenberger, Martens and Metzger gauges. Most of the stress-strain curves were obtained with either a 2 in. commercial Metzger gauge, or an 8 in. modified Metzger gauge. The reasons for using the modified Metzger gauge were as follows: In our strain measurements, we were interested in two things, sensitivity and range. The commercial 8 in. Metzger gauge is equipped with a lever with a 1:10 ratio. This gives strain readings of a sensitivity greater than can be plotted even with the aid of a magnifying glass on a 10 by 16 in. sheet of cross-section paper. By changing the lever ratio from 1:10 to 1:5 the range was doubled, while the sensitivity was still greater than can be recorded on a 10 by 16 in. graph sheet. It may be noted that most of our strain readings were as great as .015 in. per in. Often they were much greater. With the modified 8 in. Metzger gauge, strain readings of .025 in per in. could be obtained without the necessity of resetting the gauge. The gauges were calibrated and found to be of satisfactory accuracy. Curve 119 in Fig. 6 shows two sets of readings. One set represented by dots shows readings obtained from the 2 in. Metzger commercial gauge, while the circles represent readings obtained from the modified 8 in. Metzger gauge. Both instruments were mounted on the same specimen during one and the same test. These two sets of readings serve as a check of the 2 in. gauge against the 8 in. gauge.

COMPRESSION TESTS OF THIN SHEETS

Thin sheets subjected to compression loads require bracing to prevent buckling. Such bracings inevitably introduce an experimental error. To reduce this experimental error to a minimum, and to ensure that, whatever the value of the error may be, it remains constant throughout the test, three objectives should be striven for. 1. The thin sheet specimen should be continuously supported; 2. The pressure on the brace should be as slight as possible, consistent with avoiding buckling of the specimen; 3. The pressure should remain constant and be independent of the swelling of the specimen resulting from the compression. All three objectives were very easily and effectively obtained with a set of cast iron blocks presenting flat surfaces of 3 in. by 1 in. Cast iron, we believe, is preferable to other steels, since it does not warp or spring when it is machined. It may be ground very easily to a quite truly flat surface. The clamps, by means of which the braces were held in contact with the specimen, consisted of two 1 in. sq. bars each 40 in. long (Fig. 1). These bars were clamped at their extremity by means of C clamps. The amount of tightening of the C clamps was determined by the trial and error process. If they were insufficiently clamped the specimens would buckle. By tightening the C clamps progressively and in a slightly increasing amount on successive tests, the minimum required tightening was determined. For the purpose of obtaining the third objective, which was to ensure that whatever pressure was exerted by the clamps on the specimen this pressure would remain substantially constant throughout the test, the clamps were selected of a length of

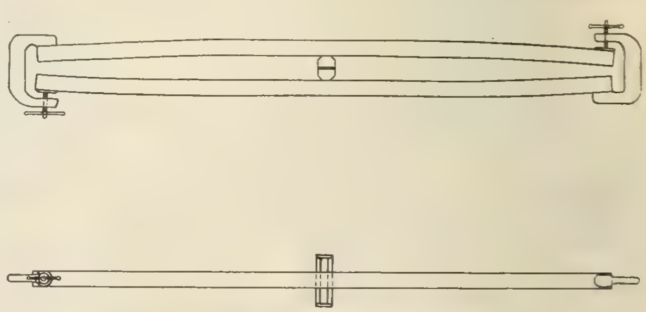

Fig. 1—Thin sheet testing fixture.

[1]The Bureau of Aeronautics assumes no responsibility for any statements contained in this paper.

40 in. With these long clamps the slight swelling of the specimen during the test would produce a change in pressure exerted by the clamps of only a few pounds.

As a braced thin sheet specimen is compressed, a certain amount of load is, by means of friction, transferred from the specimen to the braces. This amount of load is a function of the pressure exerted by the clamps, but is independent of the size of the specimen. Thus, in case of thin sheets, say 0.030 in. sheets, it comprises an appreciable proportion of the total load, and thus constitutes an appreciable error, while in case of heavy sheets, say 0.125 in. sheets, this error may be so small as to be negligible.

We believe this frictional error develops very fast during the early stages of the test, and with clamps designed as our clamps were—to keep the pressure on the specimen constant throughout the test—once developed, this frictional error remains constant. All our uncorrected compression stress-strain curves show quite satisfactory initial straight lines, none of which, however, pass through the zero point. This is in agreement with similar published compression stress-strain curves of other experimenters which we have seen. However, we have already rationalized the error due to friction between the braces and the flat sheet specimen. We believe further that the error can be fairly correctly evaluated and thus a correction can be made for it.

The circles in Fig. 2 represent the experimental values plotted direct from the laboratory data. The test was run continuously without either stopping the machine or resetting the strain gauge. Note that the straight line 2-18, when continued, passes to the left of the origin of the coordinate axes. This, in our tests of thin sheets, was always the case. After reading 33 the machine was reversed and the load decreased. The specimen thus started to elongate and the friction between braces and specimen changed sign. The vertical drop from point 33 to the continuation of the line 35-48, we believe, constitutes double the friction error plus whatever lag there may have been in the gauge. The solid line on Fig. 2, we believe, comes close to representing the true compression stress-strain curve of the material. It was obtained by decreasing all experimental values from 0 to 33 by an amount slightly less than one half the vertical distance between the point 33 and the continuation of line 35-48, and by increasing the readings for the line 35-48 by an amount slightly more than one-half this vertical distance. By this slightly more and slightly less than one-half we have attempted to account for the lag in the gauge. This lag we know no way of determining exactly. That there is a lag we deduce from the fact that the solid line curve must pass through point 1. Furthermore, the error due to lag decreases the increments to be subtracted from readings 1 to 33, and increases those to be added to the readings 35 to 48.

All our compression stress-strain curves have been corrected as illustrated by Fig. 2.

In tension tests of thin sheets we frequently obtained graphs which appeared satisfactory except that the zero reading failed to coincide with the origin of the coordinate system. In cases of tension tests this discrepancy is due to initial wow in the specimen, to eccentricity, and possibly, in a measure, to lag in the gauge. Some of our curves were offset so as to make them pass through the origin. When this was done the zero reading was not shown by means of a small circle as all other experimental readings are shown.

Some of our stress-strain curves manifest a sharp break in the curve as is illustrated by curve 113, Fig.

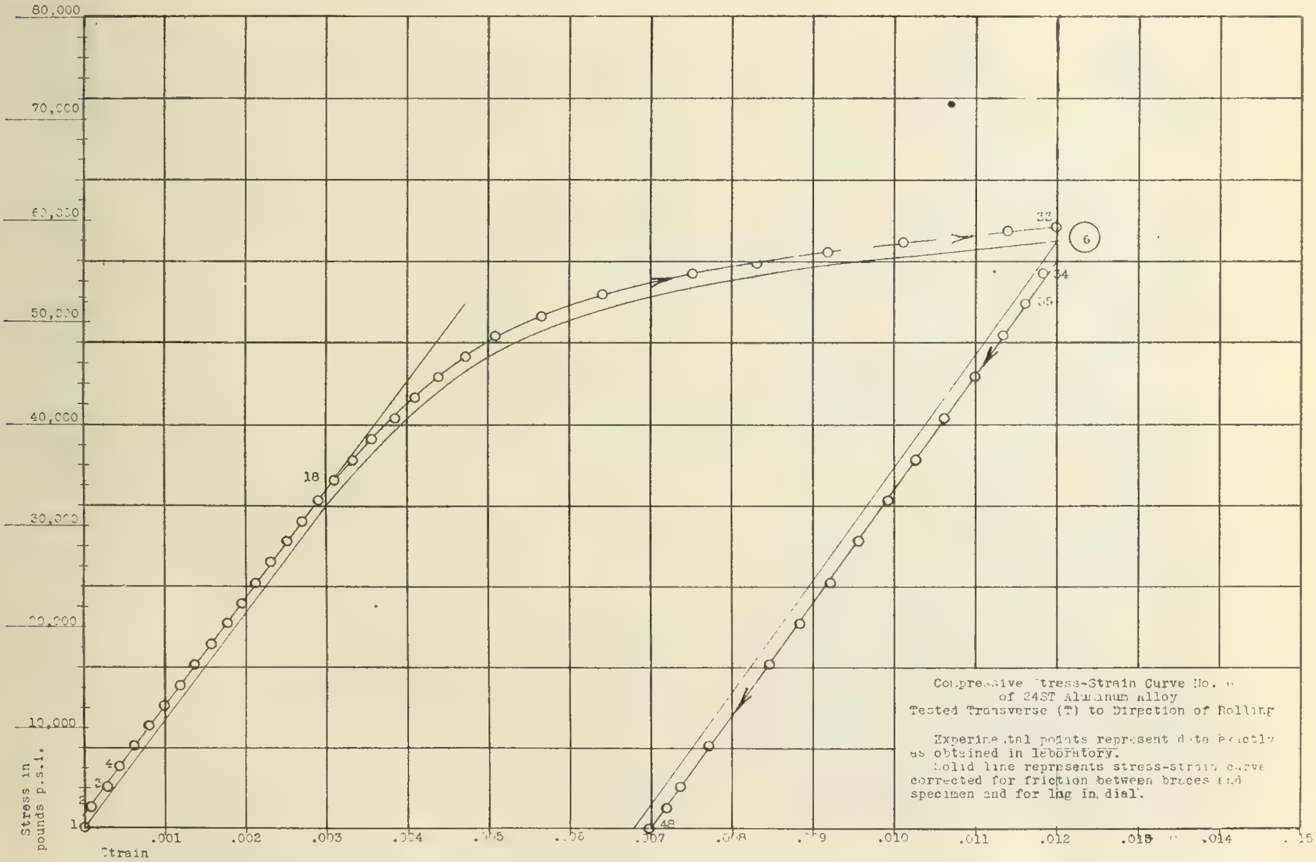

Fig. 2—Compressive stress-strain curve No. 6 of 24ST aluminum alloy tested transverse to direction of rolling.

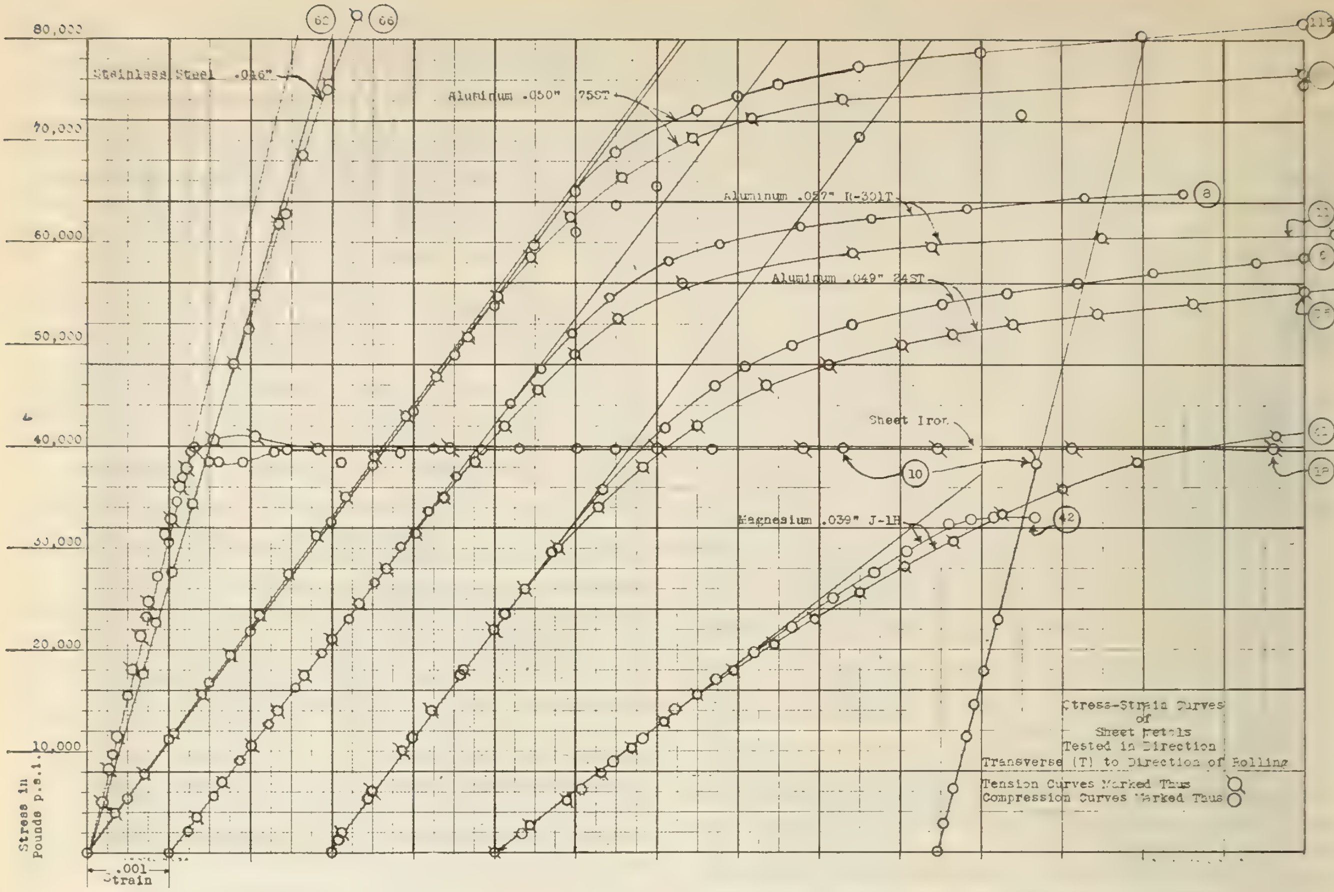

Fig. 3—Stress-strain curves of sheet metals tested in direction transverse to direction of rolling.

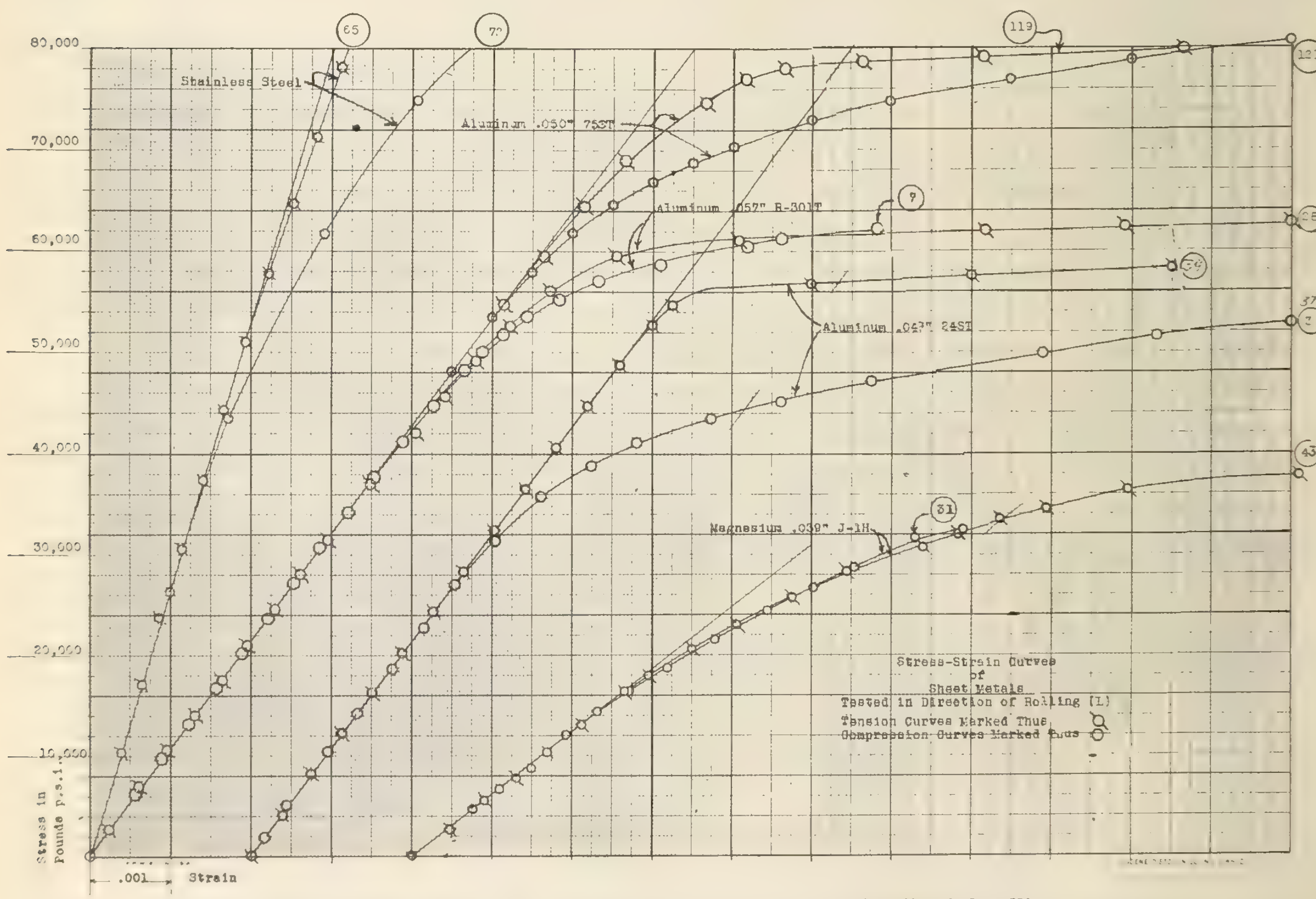

Fig. 4—Stress-strain curves of sheet metals tested in direction of rolling.

6. The sheet of clad metal consists of a hard core covered by a soft cladding. The outer layers of the specimen reach the yield stress before this stress is reached in the inner core of the metal. This gives rise to a primary and secondary modulus of elasticity. This explanation appears very plausible. So plausible, in fact, that we would expect a pronounced and sharp break in all stress-strain curves of clad metals. That we do not always obtain this sharp break is manifest by our curves.

Test Results

Notation: On all figures, where tension and compression stress-strain curves are shown, the compression stress-strain curve is indicated by plain circles, the tension curve by circles with a line at 45 deg. Only in Figs. 6 and 17 which comprise nothing but tension stress-strain curve, are the 45 deg. cross-lines omitted.

T stands for transverse to direction of rolling or cross-grain.

L stands for longitudinal or with grain.

Discussion of Figures

Fig. 3 presents tension and compression stress-strain curves of magnesium, three kinds of aluminum, stainless steel and sheet iron, all sheets tested cross-grain. Fig. 4 presents tension and compression stress-strain curves of the same sheet metals except sheet iron, tested with grain. Figures 5 and 6 present compression and tension stress-strain curves, respectively, of sheets of different gauges, while Fig. 7 presents tension and compression stress-strain curves of R 303 T and 75 ST extrusions. Fig. 8 presents tension and compression stress-strain curves of stainless steel sheets.

It may be noted that, in Fig. 3 (metals tested cross-grain) for the light alloy metals the compression stress-strain curves run coincident with, or slightly higher than, the tension stress-strain curves. Our curves are stress-strain curves plotted in the conventional manner. That is, no correction is made for the increase of cross-section area in case of the compression test, nor for the decrease of cross-section area in case of a tension test. Our stress is defined as the load divided by the original cross-section area. If the true stress-strain curve were plotted the compression curve would appear below the one which we plotted, and the tension curve would run higher. Although the true tension and compression stress-strain curves would not absolutely coincide, they would be so nearly identical, well within experimental error, that they could be considered identical.

What we have just said about Fig. 3, sheets tested cross-grain, does not apply to Fig. 4, sheets tested with grain. Whereas in Fig. 3, sheets tested cross-grain, the compression stress-strain curve runs coincident with or above the tension stress-strain curve, on Fig. 4, sheets tested with grain, except for magnesium, the reverse is true. In case of true stress-strain curves corrected for variable cross section areas the divergence between the tension and compression stress-strain curves would be even more pronounced. An attempt at an explanation of this phenomenon is made in the following chapter.

Effects of Cold-Working on Elastic Properties of Metals

Possibly it should be stated that the author is not a metallurgist, nor is he an aero-engineer. He lays claim

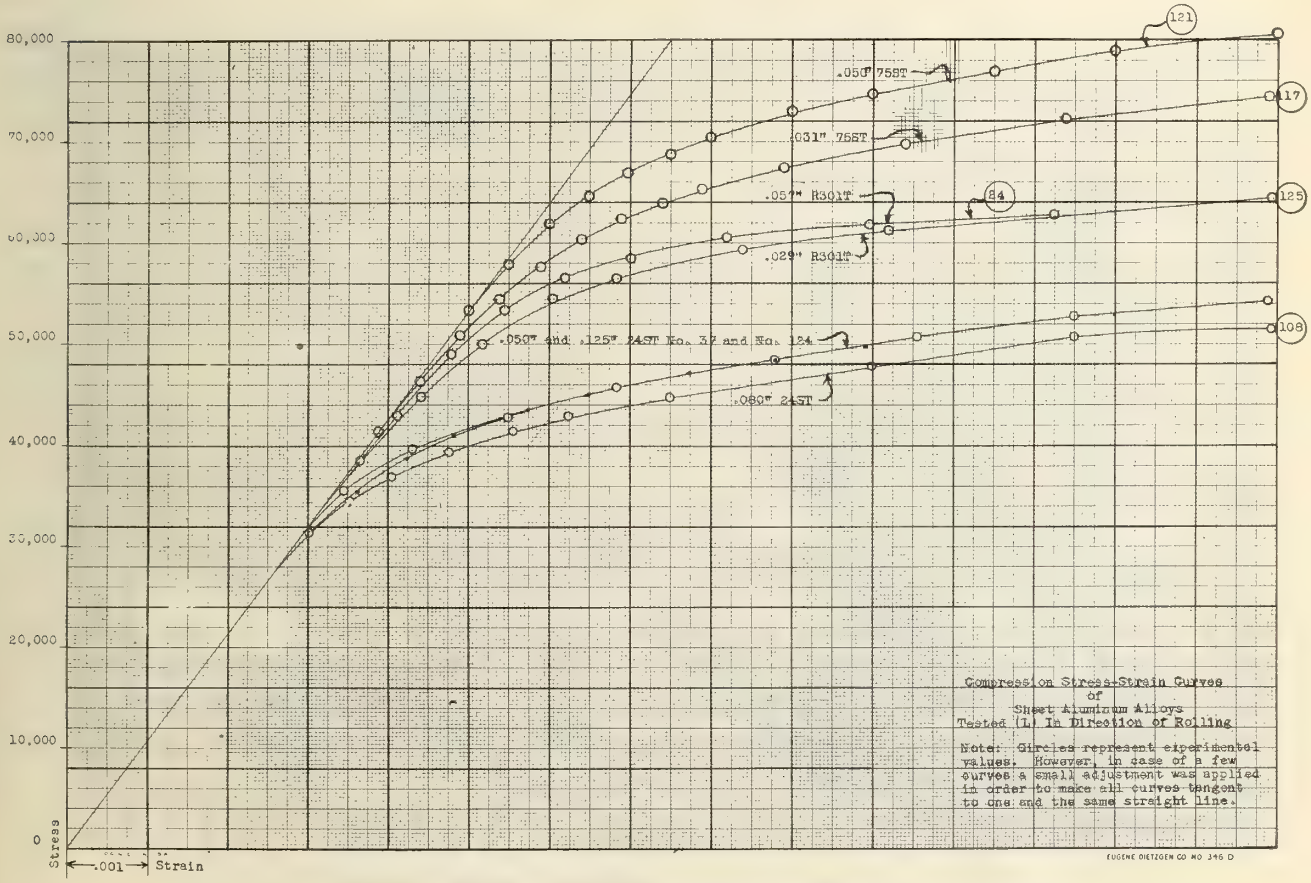

Fig. 5—Compression stress-strain curves of sheet aluminum alloys tested in direction of rolling.

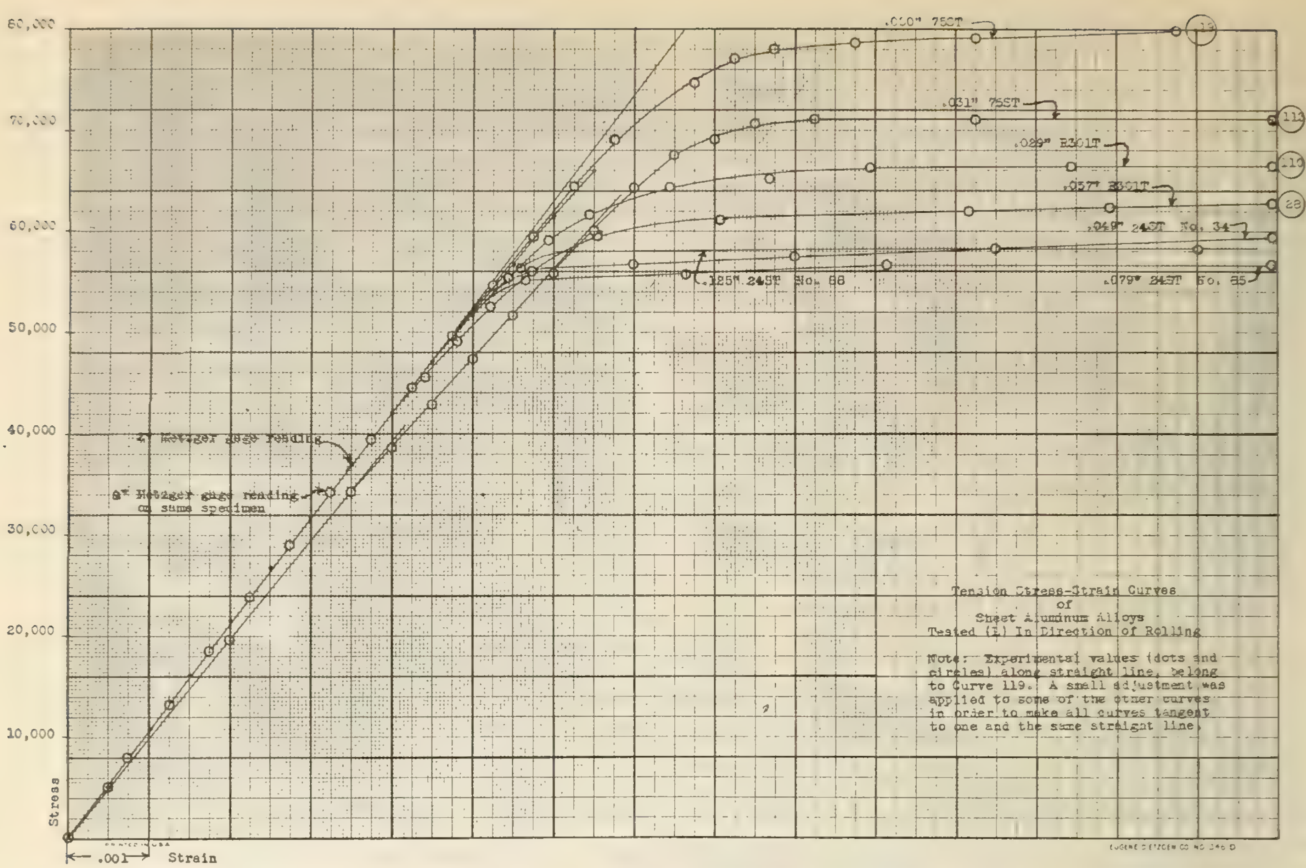

Fig. 6—Tension stress-strain curves of sheet aluminum alloys tested in direction of rolling.

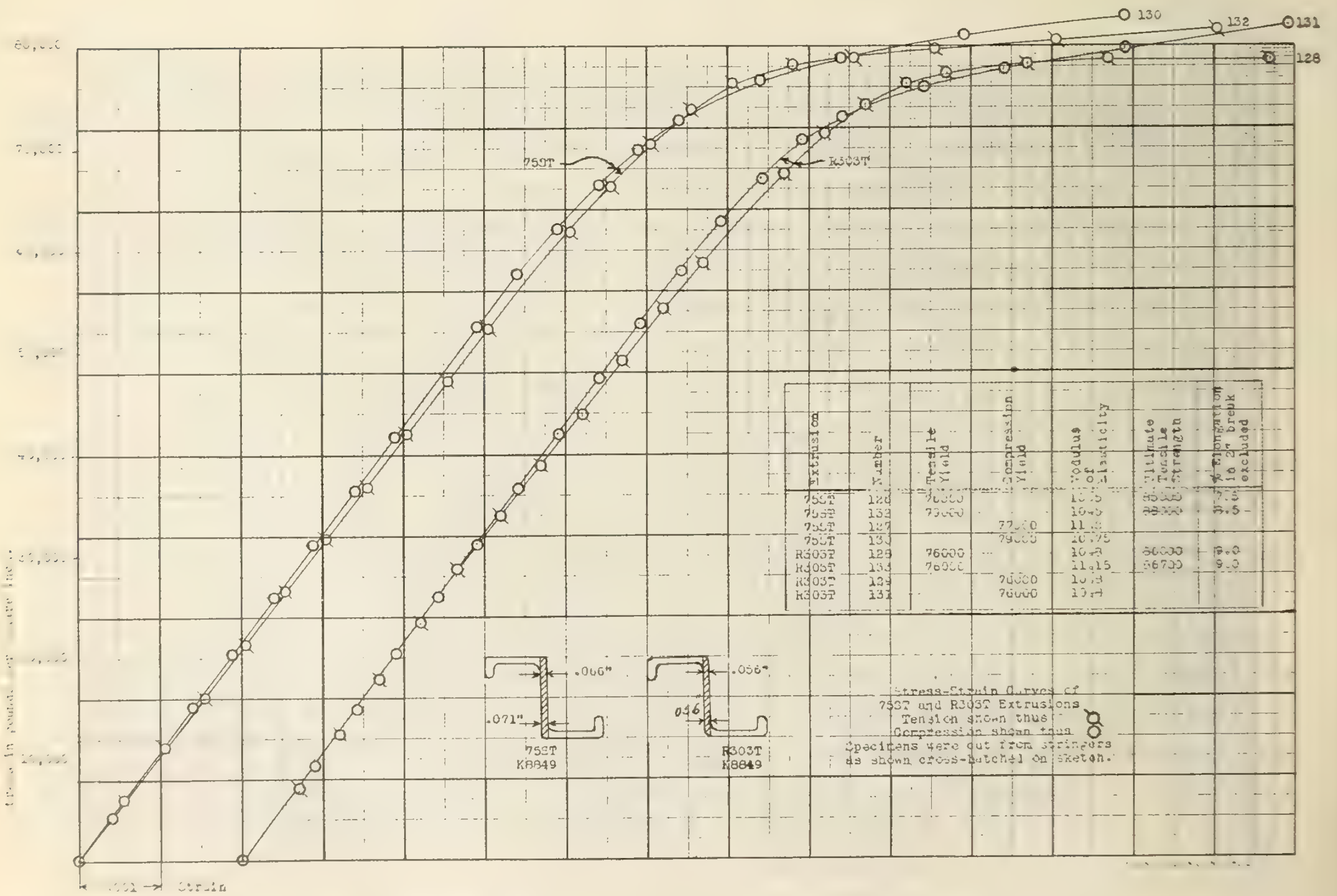

Fig. 7—Stress-strain curves of 75ST and R303T extrusions.

to no other qualification but that of strength expert, or strength engineer. His familiarity with steel is of thirty-five year standing. His familiarity, such as it is, with the light metals is but of very recent date. What he does not know about the manufacture or the working of aluminum and magnesium would fill volumes. Only after the completion of this investigation did he learn that the R in R 301 T stood for Reynolds. This proves his nearly complete ignorance of trade terms. The Bureau of Aeronautics wanted certain metals to be investigated and supplied these metals from their source, the Navy Yard in Philadelphia. Thus, the author has made his investigations quite objectively.

It is one thing to record facts. It is one degree better to explain these facts. Our attempt at explaining the spread between the tension and compression stress-strain curves in Fig. 4, tested with grain, notably for 24 ST, in view of our ignorance of manufacturing practices is frankly conjecture. Possibly someone familiar with manufacturing processes may discuss this paper and tell us what element of truth may be contained in this conjecture. One does not need to be an aero-engineer to know that stringers and sheets are stretcher-straightened, and are bent and twisted between the time they leave the plant and the time they finally are assembled as an integral part of an aeroplane. As strength engineers we have but slight interest in the properties of the material as it leaves the plant. Our primary interest is in what the properties are, once the material forms part of an aeroplane. If this material is bent or stretcher-straightened, thus cold-worked, we then must know what are the effects of cold-working on the material's properties.

Figure 9 presents six stress-strain curves of 24ST extrusion. The black dots, curves 49 and 51, present the tension and compression stress-strain properties in the as-received state. When this material was cold stretched two per cent, and subsequently tested in tension (curve 54) its elastic limit and yield stress were very materially increased. When it was cold-compressed two per cent, and subsequently tested in compression (curve 56) its elastic limit and yield stress were similarly increased, substantially the same amount. However, when it was cold-stretched two per cent, and subsequently tested in compression (curve 48) both its elastic limit and yield stress were materially reduced. The same proved to be the case when the material was cold-compressed two per cent and subsequently tested in tension (curve 53).

Figure 10 shows the restoring effect of aging and the application of mild heat (100 deg. C.) on the elastic properties of 24 ST aluminum after being cold-worked.

Figure 11 shows the effects of cold-working in tension on the elastic properties in compression, as well as the effect of aging on the cold-worked material for O-1-H.T.A. magnesium alloy extrusion.

The interesting feature of these figures, to the author, is the fact that the laws of effects of cold-working on magnesium and aluminum alloys seem to be identical with those governing mild steel.

In 1918, the author published a paper entitled, "Effects of Cold-Working on the Elastic Properties of Steel."[2] Incidentally, in this paper is described how steel bars 22 in. in length were compressed to a length of 19 in. maintaining perfect alignment throughout.

[2]"Effects of Cold-Working on Elastic Properties of Steel", by J. A. Van den Brock, Carnegie Scholarship Memoirs, Vol. IX, 1918; also *Engineering*, July 16, 1918, and *Zeitschrift fur Metallkunde Band* XII. Heft 8.

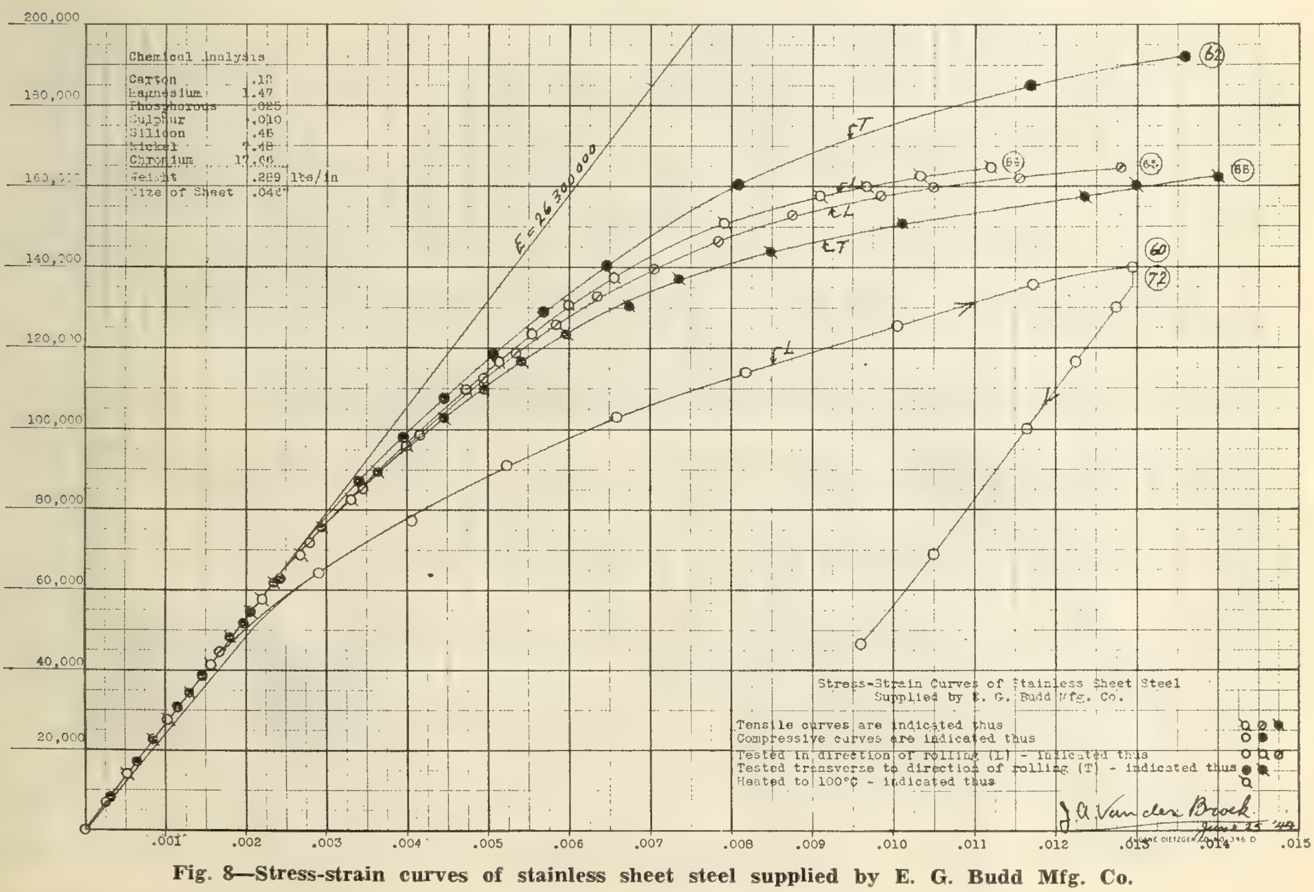

Fig. 8—Stress-strain curves of stainless sheet steel supplied by E. G. Budd Mfg. Co.

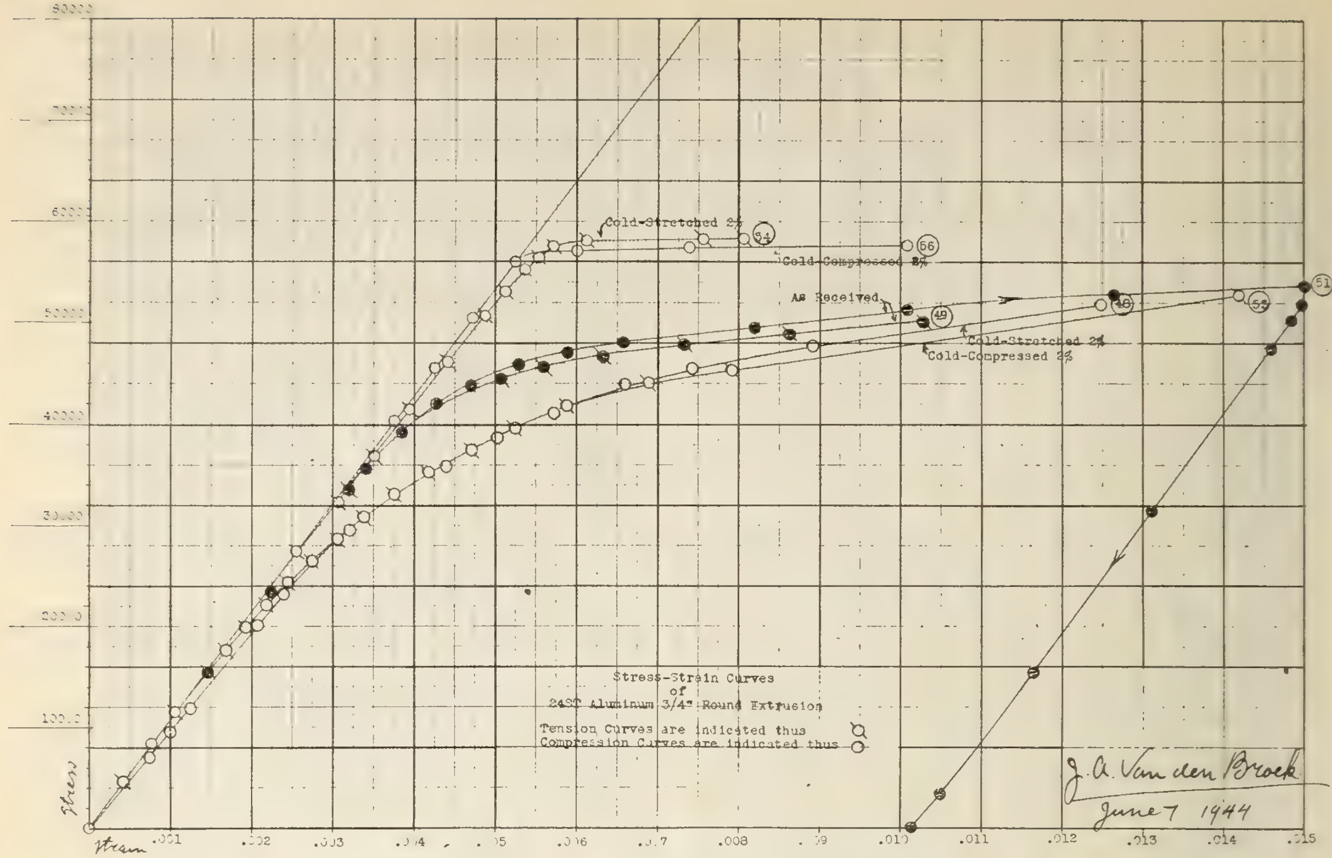

Fig. 9—Stress-strain curves of 24ST aluminum ¾″ round extrusion.

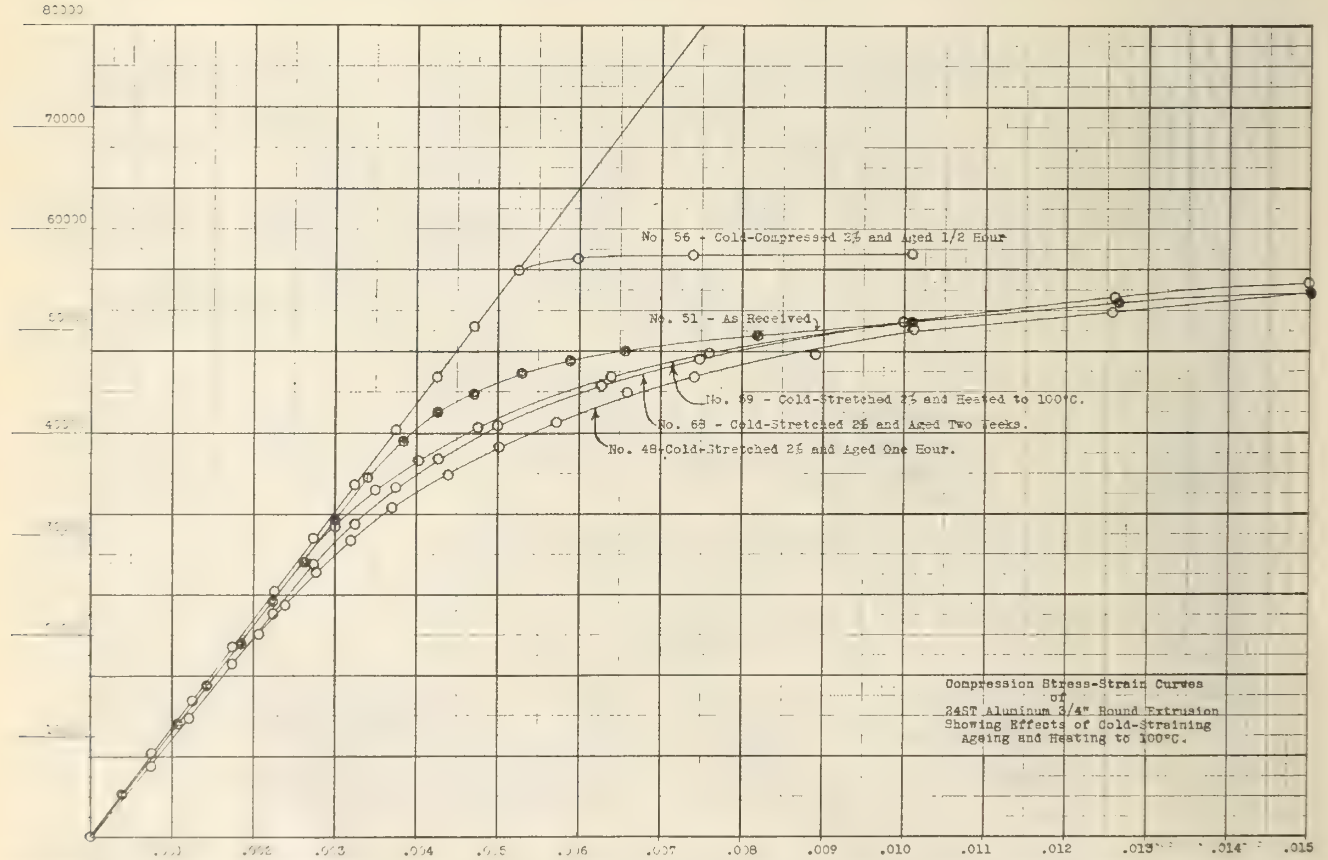

Fig. 10—Compression stress-strain curves of 24ST aluminum ¾″ round extrusion, showing effects of cold-straining, aging and heating to 100°C.

This same method was used in the present case in order to cold compress specimens preparatory to subsequent testing of the cold-compressed material in either tension or compression.

In this paper of the year 1918 the following laws were formulated:

1. "When mild steel is cold-worked and properly aged, or tempered and subsequently tested in the same sense as that of the cold-working, its elastic limit may be raised more than 100 per cent. and from 10 to 20 per cent beyond the stress at which cold-working was discontinued."

2. " When mild steel is cold-worked in one direction and properly aged and tempered, though tested in either one of two senses of a different direction (for example, cold-stretched and aged and subsequently tested in either positive or negative torsion) then its elastic limit may be raised some 50 per cent.

3. " When mild steel is cold-worked in one direction and sense and properly aged or tempered, though tested in the same direction but opposite sense, then the elastic limit remains at the value of the original elastic limit, but the yield point is raised."

4. " When mild steel is cold-worked in any direction or sense, and tested in any direction or sense without any aging or tempering, then the elastic limit falls below the value of the original elastic limit, often down to zero."

5. " Tempering cold-worked steel at temperatures from 100 to 300 deg. C, or aging cold worked steel, has a tendency to perfect its elastic properties. Tempering merely accelerates the effects of time."

The author would now like to add to these laws, a law which was proved at the time but not emphasized by the statement of a formulated law, namely:

6. The effects of cold-working on the elastic properties of steel are a function of the strains involved in the cold-working processes and are independent of the cold-working stresses involved in these processes.

Our investigations of the effects of cold-working on the elastic properties of aluminum and magnesium alloys has not by any means been as thorough and far reaching as were those for mild steel. Everything seems to point, however, to the fact that, in the laws quoted above, the expression, " 24 ST aluminum alloy extrusion ", or " O-1-H.T.A. magnesium alloy extrusion ", may be substituted for the words " mild steel ", without doing violence to the truth.

Our discussion of the curves in Fig. 4, tested with grain, was the immediate cause for this digression into the field of cold-working effects. We believe our figures relative to the cold-working effect may conceivably explain the curves in Figs. 3 and 4. For example, specimens tested cross-grain were presumably in the rolling process, not cold-worked in the cross-grain direction. Thus their elastic properties in tension and compression are substantially identical (See Curves 49 and 51, Fig. 9, and Curves 6 and 35, Fig. 3). If the sheet during the last passage through the rolls was cold enough to constitute a cold-rolling process, then we would expect the compressive elastic properties to be depressed and the tensile elastic properties to be raised. We find the stress-strain curves for 24 ST in Fig. 4 substantially similar to curves 54 and 48 in Fig.

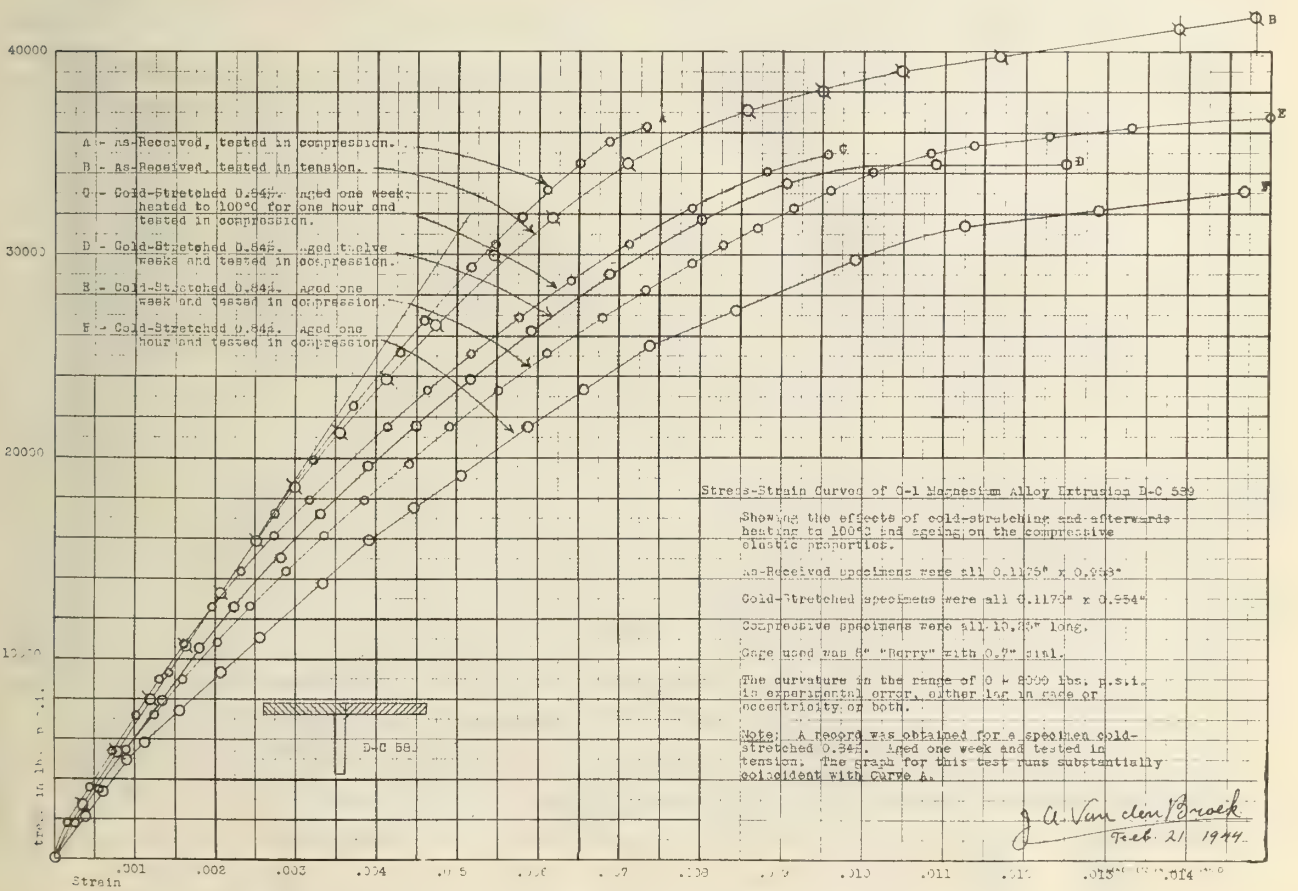

Fig. 11—Stress-strain curves of O-1 magnesium alloy extrusion D-C 589.

9. This suggests that the cold-rolling effect may account for the divergence of the two 24 ST curves in Fig. 4. The same explanation might conceivably apply to the 75 ST curves in Fig. 4. It evidently does not apply to the R 301 T curves.

Not uncommonly we encounter the view that cold-working results in strain-hardening, and that strain-hardening results in greater strength and is, for that reason, beneficial. One definite result of cold-working is that it results in a decrease of ductility, which in theory of strength is about the most harmful thing that can happen. It may result in strain hardening, or strain weakening, depending on whether the subsequent strains under service conditions are of the same sense, or of a sense opposite to those involved in the cold-working process.

In stretcher-straightening or while bending and fitting into place, a certain amount of cold-working is probably inevitable. Unless done for a definite purpose, as for example in drawing wires, it seems best to regard cold-working as an evil, probably a necessary evil, but not as an advantage.

Column Tests

Figures 12 and 13 present pin-ended column curves of mild steel round, 24 ST extrusion round, and 75 ST extrusion Z section, respectively. The method of testing used in obtaining these figures was first described in "Rational Column Analysis".[3]

Figure 14 shows one of the short steel columns used in the series of tests illustrated in Fig. 12. Figure 15 shows the equipment used in making the templets for the Z stringers. A short section of the extrusion to be tested is placed on a disc having exactly the same diameter as that of the mould. This disc is balanced on a phonograph needle. The correct length of the sample, to be balanced on the disc, is determined by trial and error. If it is too long, the contraption is unstable; if too short, it is insufficiently sensitive. Once the sample section of the stringer is properly balanced it is brought down to rest on the wooden board and frozen on the disc by means of a few drops of molten wax. The eye dropper and candle used for this purpose are shown in the photograph. Next, the disc and sample stringer section are transferred to a mould. They are then clamped tightly in place by means of the bridge and clamp screw shown in the figure. Some type-metal is melted and poured around the sample. After cooling, the templet is pushed out of the mould through the perforations in its bottom and the sample removed. Once this templet is inserted in the depression of the column-end provided for it, it serves to align, with a high degree of accuracy, any column specimens cut from extrusions identical with the sample extrusion. The mould is made slightly larger than the depression in the column-end in order

[3] "Rational Column Analysis", by J. A. Van den Broek, *The Engineering Journal*, December, 1941; closing discussion June, 1942.

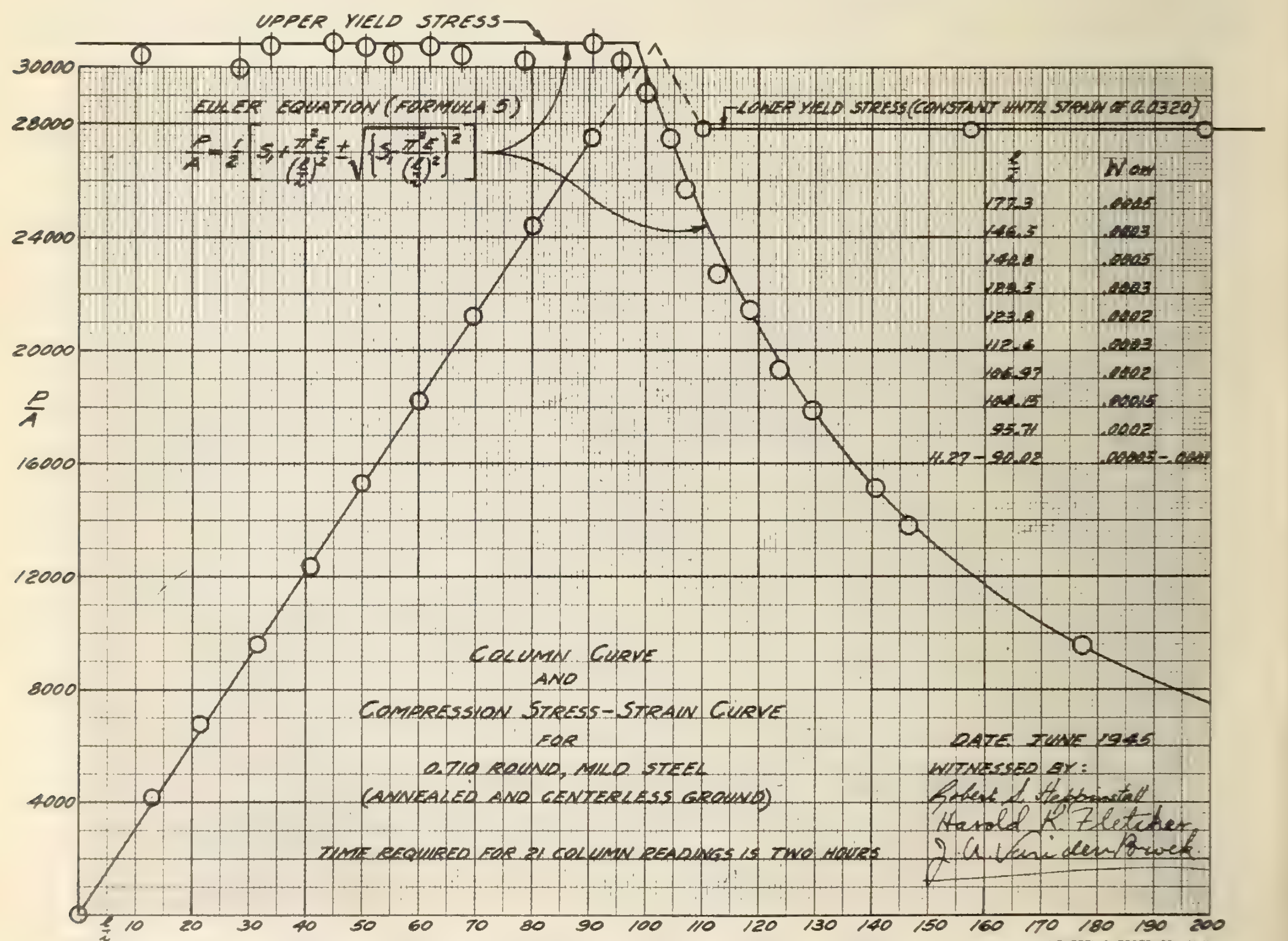

Fig. 12—Column curve and compression stress-strain curve for 0.710 round, mild steel.

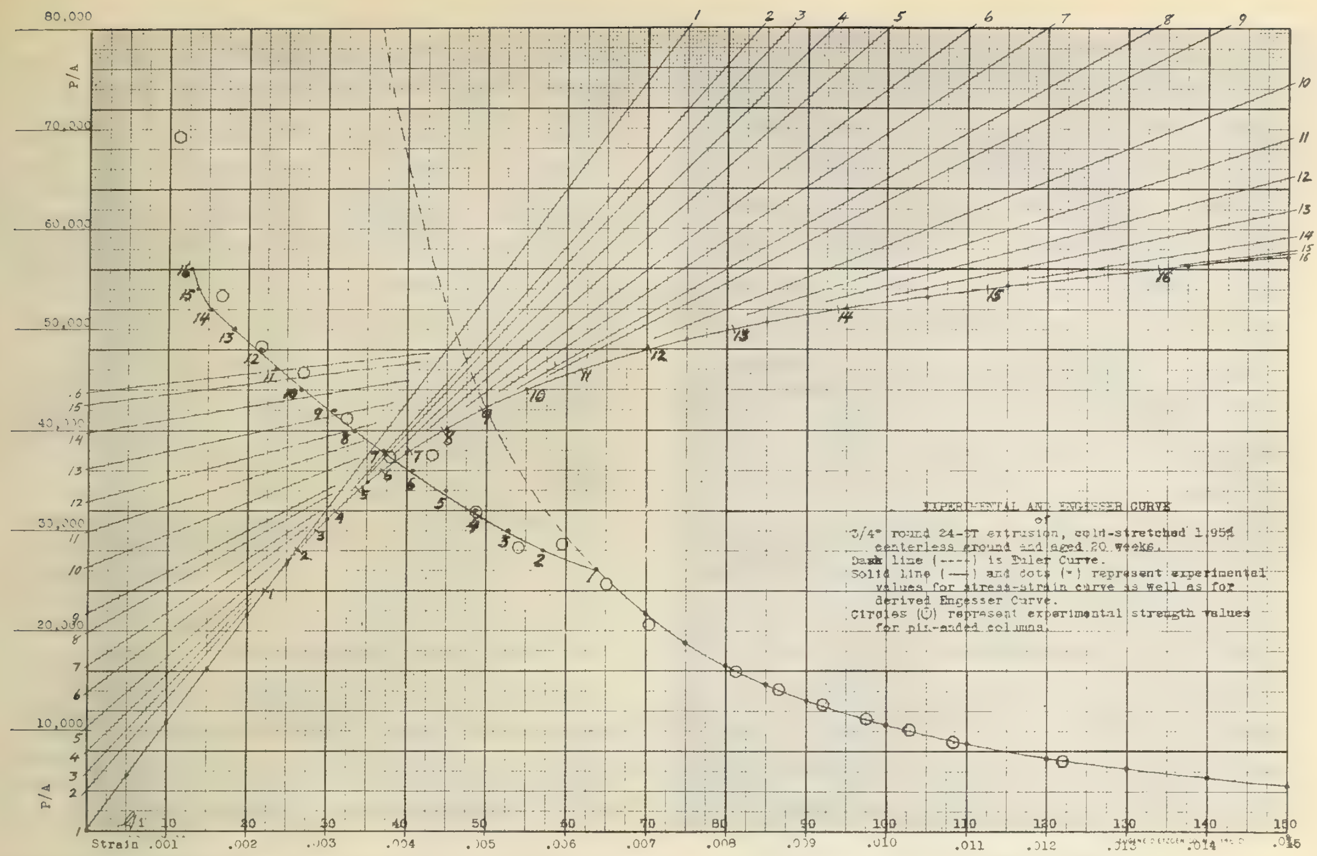

Fig. 13—Experimental and Engesser curver of ¾" round 24ST extrusion, cold-stretched 1.95%, centreless ground and aged 20 weeks.

to allow for the contraction of the type metal as it cools.[4]

Figure 12 represents the final result of four years of effort to obtain the best possible record of a series of pin-ended column tests. The time taken in perfecting the specimens as well as the column ends was considerable. The time consumed in obtaining twenty-one readings in the laboratory was but two hours. Twenty-one specimens were tested and all these test results are recorded on Fig 12.

Figure 13 presents a stress-strain curve, an Engesser curve, and an experimental column curve for a ¾ in. round 24 ST extrusion. The extrusion was centreless ground to uniform roundness, cold-stretched 1.95 per cent, and aged twenty weeks. The stress-strain curve was determined from a short specimen while being tested as a pin-ended column. This stress-strain curve corresponds closely to curve 59 in Fig. 10. Tangents were drawn to the stress-strain curve at points 1, 2, 3, etc., and from these tangents, the Euler and Engesser column values were computed. These values, thus computed, were plotted as solid round dots, and a solid black line drawn through them. The experimental column strength values are shown by circles.

Figure 16 presents experimental column curves of 24 ST, 75 ST and R303T identical extrusions.

The Engesser curves in Figs. 18 and 19 were obtained from stress-strain curves as described above. The stress-strain curves from which they are obtained are referred to by number, and may thus be located in the various other figures. The circles in Figs. 18 and 19, therefore, represent experimental values only in the sense that they were obtained from experimentally determined stress-strain curves. They do not represent experimental values of actually tested columns.

Evaluation

A great varitey of tests have been conducted and a large number of values have been established. For example, proportional limits, yield stresses, moduli of elasticity both in tension and compression as well as in direction of rolling and transverse to direction of rolling, have been established. In addition, weight and ductility must be taken into account. In order to evaluate metals for the purpose of aeroplane construction, this array of data must be sifted, arranged, coordinated, and some of it rejected.

Figure 17 presents tension load-strain curves for magnesium, aluminum, and for stainless steel bars of the same weight. Thus, on this one graph several physical constants, such as weight, proportional limit, yield-stress, and modulus of elasticity are reduced to one and the same standard. This constitutes a very desirable simplification in our evaluation task. Unfortunately, however, it falls short of the ideal on at least two counts. First, metal under compression loads is much more critical in strength determination of aeroplane structures than is the same metal subject to tension loads, and, second, Fig. 17 fails completely in evaluating the important physical constant of ductility. To construct graphs similar to Fig. 17, but for compressive stress-strain properties instead of tension properties, would be meaningless, as metal under compression in aeroplane structures fails by buckling.

Column strength, in case of material with a constant modulus of elasticity, is expressed by the

[4]See "Strength of Magnesium Alloy Columns", by F. A. Rappleyea, *Journal of Aeronautical Sciences*, July, 1945.

Fig. 14—Showing pin-ended column under test.

familiar Euler equation, $P/A = \frac{\pi^2 E}{(l/i)^2}$. In case of material such as we are considering, in which the modulus of elasticity decreases as the stress increases, the equation for column strength is the Engesser formula, $P/A = \frac{\pi^2 E'}{(l/i)^2}$. The Engesser formula is the same as the Euler formula except that E' is variable instead of constant. Thus the Engesser column curve may be obtained from the stress-strain curves in Fig. 4 for example. If, for purposes of convenient comparison, we want column strength graphs for columns of equal weight of sheet iron, stainless steel, aluminum, and magnesium all to be plotted on the same graph, then the conventional ordinates of P/A and l/i cannot be used. Instead, specific columns of similar cross-sectional areas must be used. This is not a serious handicap, so long as we are primarily interested in comparative values, since graphs for different size columns, so long as the areas are similar and the weights of the columns represented in the same figure are all equal, would be similar.

Figure 18 represents compression limit-strength curves of solid round columns of equal length and weight. Compression limit-strength curves for extrusions would appear similar. Figure 19 shows compression limit-strength curves of sheets of equal length, width, and weight.

By the introduction of Figs. 18 and 19 we have eliminated one of the disadvantages which we mentioned in connection with Fig. 17. The other disadvantage which was mentioned, the inability to evaluate on one set of graphs the property of ductility along with those of weight and stress-strain relationships, remains. Thus, in order to effect an evaluation of structural properties on the basis of Figs. 17, 18 and 19, we shall have to refer to the values for ductility shown in Table I.

On the basis of Figs. 18 and 19 and Table I, we believe a few general conclusions are possible:

1. Sheet iron appears to be superior to stainless steel in the long column range ($l > 21.5''$ or $l/i > 72.4'$ in Fig. 18), because, with substantially the same weight, sheet iron manifests a greater value for the modulus of elasticity.

2. Stainless steel does manifest a slightly greater percentage of elongation than 24 ST aluminum. Its column strength, however, is so markedly inferior to that of columns of 24 ST of equal weight that, in our opinion, we are justified in eliminating stainless steel from further consideration.

3. R 301 T aluminum appears to be inferior, both in ductility and in column strength, to 75 ST aluminum sheet. Of the aluminum alloy tested, R 301 T may, in our view, be eliminated from consideration, and thus the choice is reduced to deciding between 75 ST and R 303 T with superior strength, and 24 ST with superior ductility.

4. Both in ductility and in strength properties R 303 T and 75 ST appear so similar that, on the basis of the few tests which we conducted, we are unable to express a preference between them. Possibly R 303 T may show slight superiority over 75 ST, because of a ten per cent greater ductility. The ductility of both 75 ST and R 303 T, expressed by percentage of elongation in 2 in. length, break excluded, is of the order of magnitude of nine per cent. Although not as large as that for 24 ST, the column strength in the short column range for

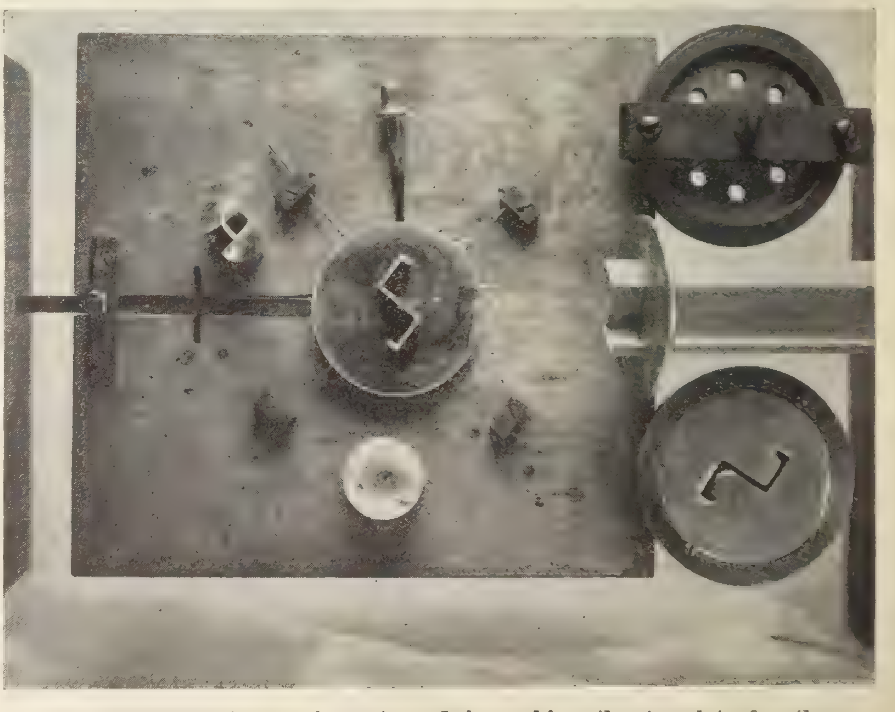

Fig. 15—Showing the equipment used in making the templets for the Z stringers.

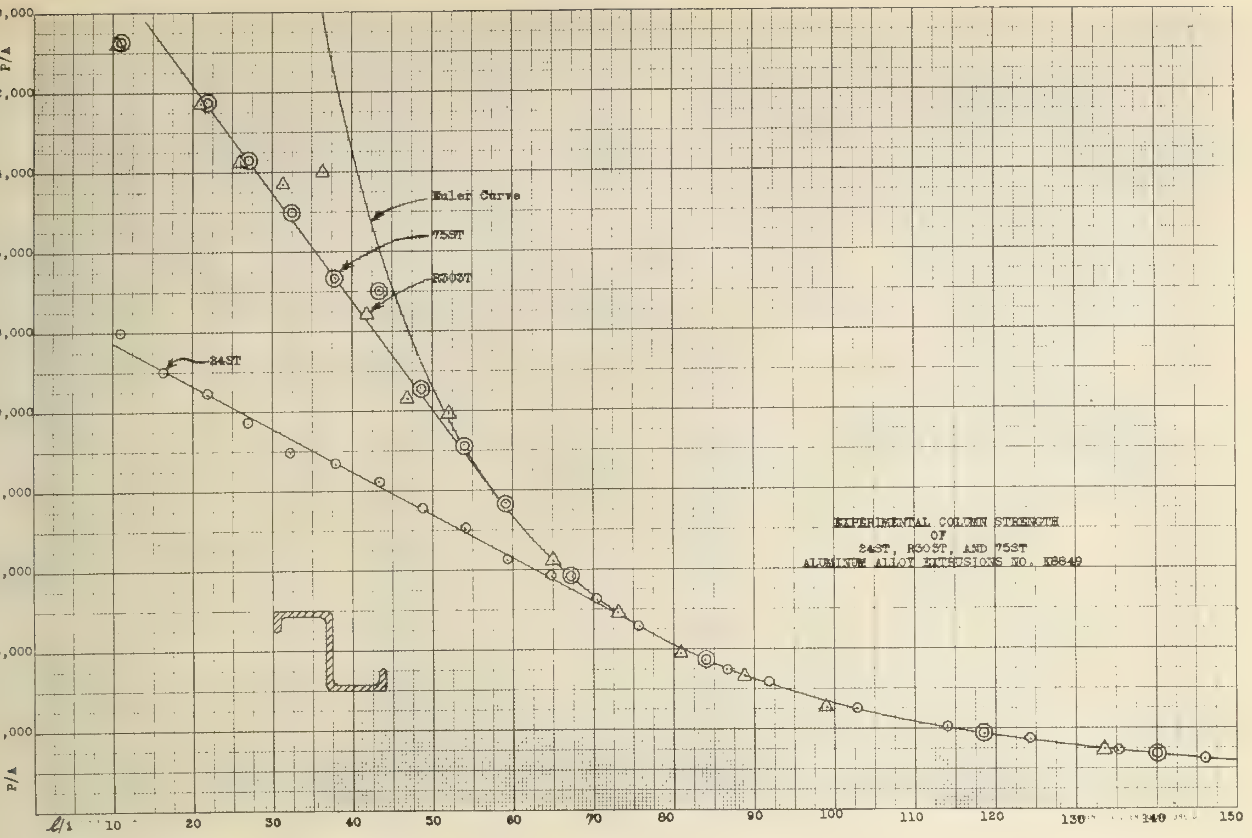

Fig. 16—Experimental column strength of 24ST, R303T, and 75ST aluminum alloy extrusions.

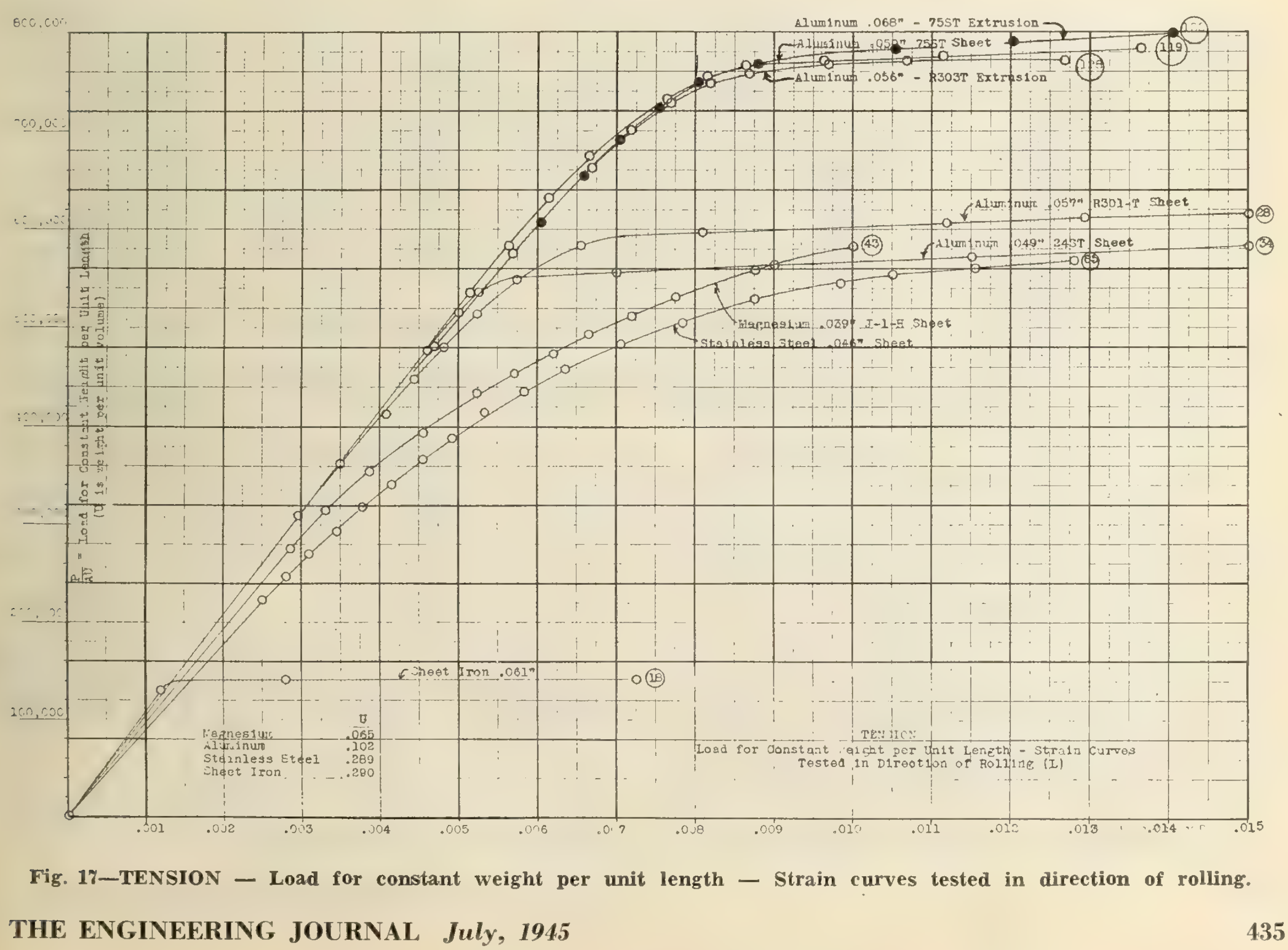

Fig. 17—TENSION — Load for constant weight per unit length — Strain curves tested in direction of rolling.

TABLE I

Sheet Metal	Dir. of Rolling		Test Number	Figure	Machine	Prop. Limit	Yield Stress	Ultimate Stress	Mod. of Elas.	% Elon. 2" Break Included	% Elon. 2" Break Excl.
.061" Sheet Iron	T—	Ten.	18	3	A	40000	40000	49000	31.4		
		Compr.	10	3	R	40000	40000		31.4		
.046" Stainless Steel	L—	Ten.	65	4,12	A	65000	143000	194000	26.3	23	19.5
		Compr.		4,12	R	40000	94000		26.3		
	T—	Ten.	66	3,12	A	65000	135000	198000	26.3	17	7.5
		Compr.	62	3,12	R	70000	160000		26.3		
.039" J-1-H Magnesium	L—	Ten.	43	4	A	15000	33000	47000	6.2		3.75
		Compr.	31	4	R	15000	33000		6.2		
	T—	Ten.	41	3	A	16000	39000	47000	6.2		1.5
		Compr.	42	3	R	20000	34000		6.2		
0-1 Magnesium Extrusion	L—	Ten.	B	24		16000	36000		6.15		
		Compr.	A	24		18000	37000		6.15		
.050" 24ST	L—	Ten.	34	4	A	52000	57000	71000	10.65		11.8
		Compr.	37	4	R	28000	44000		10.65		
	T—	Ten.	35	3	A	28000	49000	71000	10.8		12.8
		Compr.	6	3,7	A	33000	53000		10.8		
.080" 24ST	L—	Ten.	85	17	A	28000	56500	72000	10.5	20	14.5
		Compr.	108	16	R	28000	42000		10.65		
	T—	Ten.	84	18	A	28000	47000	72300	10.5	23	18.5
		Compr.	107	18	R	30000	49000	107000	10.5		
.125" 24ST	L—	Ten.	88	17	A	28000	57000	72000	10.5	13	14.5
		Compr.	124	16	R	28000	44000		10.65		
	T—	Ten.	77	18	A	30000	49000	72500	10.3	16	16
		Compr.	109	18	R	30000	50000		10.3		
¾" round 24ST Extrusion	L—	Ten.	49	10	A	34000	47000	70000	10.65	21.5	17.0
		Compr.	51	10,11	R	34000	48000		10.65		
.031" 75ST	L—	Ten.	113	17	A	56000	71000	80000	9.9	11	6.5
		Compr.	117	16	A	44000	66000		10.65		
	T—	Ten.	112	18	A	36000	67000	80000	10.25	14	10
		Compr.	116	18	A	49000	69000		10.4		
.050" 75ST	L—	Ten.	119	4	A	62000	78000	85000	10.6	10.0	7.5
		Compr.	121	4	A	54000	72000		10.6		
	T—	Ten.	82	3	A	48000	73000	85000	11.2	13.5	9.0
		Compr.	115	3	A	65000	77000	113000	10.9		
.068" 75ST Extrusion	L—	Ten.	132	19	A	56000	76000	86000	10.5		8
		Compr.	130	19	A	56000	77000		10.8		
.031" R 301T	L—	Ten.	110	17	A	48000	65000	72600	10.5	9	4
		Compr.	125	16	R	34000	58000		10.65		
	T—	Ten.	78	18	A	36000	61000	66300	11.2	11.5	8
		Compr.	105	18	A	46000	66000		10.25		
.057" R 301T	L—	Ten.	28	4	A	40000	61000	67000	10.65	7.8	5.75
		Compr.	7	4,5	A	40000	60000		10.65		
	T—	Ten.	11	3	A	32000	58000	66000	10.5		7.0
		Compr.	8	3	A	46000	62000		10.5		
.056" R303T Extrusion	L—	Ten.	128	19	A	30000	76000	86000	10.8		9
		Compr.	131	19.	A	56000	76000		10.8		

R 303 T and 75 ST alloys is so definitely superior to that of all other metals tested as to indicate a definite superiority except for cases in which its ductibility factor might prove to be deficient. R 303 T and 75 ST aluminum alloys thus appear definitely superior to all other metals tested, for structural purposes, in the short column range. The only contestant for the award of merit appears to be J-1 H and O-1 HTA magnesium alloy, and this contest is limited to the long range column $l >$ 27.5, Fig. 18 or l/i for aluminum > 55 and l/i for magnesium > 44).

Ductility

The author's backlog of engineering is that of steel construction. In his younger days the pin-connected railroad truss was still standard. He has lived

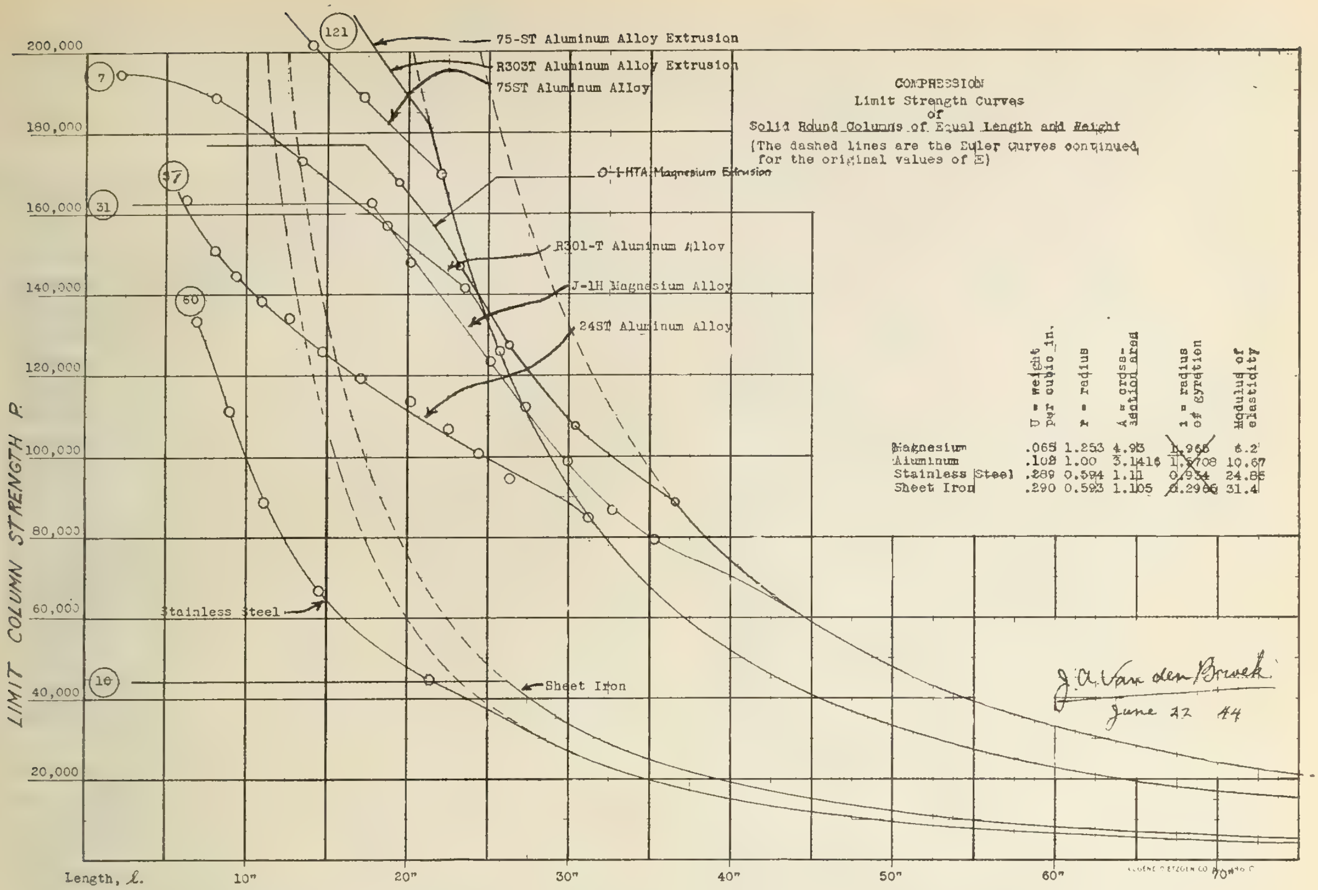

Fig. 18—COMPRESSION—Limit strength curves of solid round columns of equal length and weight.

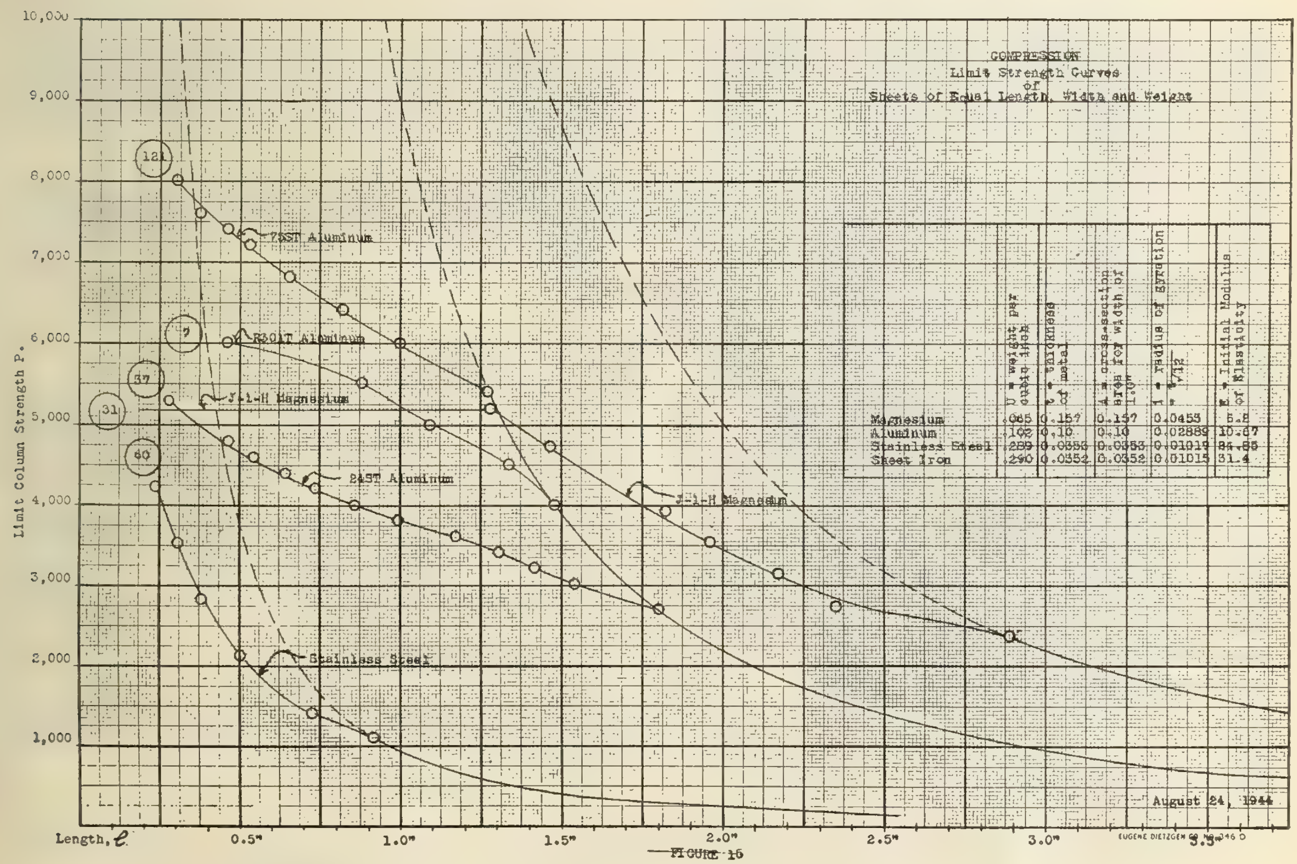

Fig. 19—COMPRESSION—Limit strength curves of sheets of equal length, width and weight.

to see these pin-connected trusses superseded by rigid trusses with gusset plates taking the place of pins. He recalls the contests between the so-called practical engineers who favoured rigid construction, and others who, on theoretical grounds, condemned it. He has seen involved theories which proved that secondary stresses made rigid construction uneconomical and inadvisable and seen rigid constructions become popular in spite of these predictions. He has seen the exponents for silicon steels and carbon steels clamour for recognition, and seen these steels rejected in favour of the old stand-by, open hearth structural steel. He has heard the secondary stress analyses praised, and at the same time known these same analyses to be completely ignored. He has seen the practice of, and has practised, bridge design by the good old fashioned rules, "When in doubt make things heavy", and "Steel is much cheaper than labour". In all this tug of war ductility has been the basic, although apparently often inarticulate, consideration. The so-called practical engineer has insisted throughout on a high measure of ductility while many theorists have tried to get along with little more than the theory of elasticity. The theorist has finally acquiesced, though sometimes begrudgingly. Thus, ductility has wiped out stress concentrations, secondary stresses, and a multitude of other sins of commission and omission. The author has attempted to rationalize this factor of ductility in a theory of strength called theory of limit design.[5]

Structural engineering as applied to aeroplanes differs from that as applied to bridges in its diametrically opposite sense of value relative to the weight factor. Even the layman is readily convinced that a light structural material is desirable. Possibly he and some aero-engineers are too readily convinced. There appears to be a rough rule in regard to metals, namely: when strength is increased ductility is decreased. The rule apparently is not infallible, since we have seen that 75 ST and R 303 T aluminum is superior to R 301 T aluminum both in strength and ductility properties. Magnesium makes a strong appeal because of its lightness. However, in order to impart to it a reasonable measure of strength, its ductility is reduced almost to the vanishing point. Yet, thirty sets of aeroplane wings have been built of magnesium, apparently with very satisfactory results. Does this mean that the structural steel engineering profession has been wrong for decades, and that long ago we should have started building railroad bridges of glass? The author does not know the answer.

For decades, "theory of elasticity" has been regarded by many as almost synonomous with "theory of strength". Structural steel is both beautifully elastic and beautifully ductile. In spite of the great emphasis on the theory of elasticity, many of the important rules and practices of structural engineering could not be justified except for the factor of ductility. Stainless steel, magnesium, and aluminum are neither perfectly elastic nor perfectly ductile. Thus, the theory of elasticity, or theory of limit design, are, at best, but rough compromises when applied to structures constructed of these metals. Important as the factor of ductility unquestionably is in structural engineering, whether it be steel or light metal structures, the profession at present does not have even a satisfactory measure of ductility, let alone a satisfactory specification as to how much we must have and as to how little we can get along with. Until such a standard is established and accepted, a rational evaluation of relative merit between 75 ST and R 303 T on the one hand, and magnesium alloy on the other hand, in the long column range, will have to be postponed.[6]

Acknowledgment is expressed to the Bureau of Aeronautics, U.S. Navy, which, with an assignment to "Evaluate High Strength Aluminum Alloys", was responsible for the work being undertaken, and which, by releasing it, made independent publication possible. Also, the author wants to express his appreciation to the Dow Chemical Company and to the Budd Mfg. Company, for their supplying the magnesium alloy and stainless steel material for test purposes. Professor E. L. Eriksen, head of the Department of Engineering Mechanics at the University of Michigan, has generously aided and cooperated throughout, and both Mr. W. E. Hawthorne and Mr. K. L. Gleason, respectively foreman and mechanic of the University Instrument Shop, have aided greatly by their advice and keen cooperation.

[5]Theory of Limit Design by J. A. Van den Broek, *Trans. Am. Soc. Engrs.*, 1940.

[6]See "The Yielding Phenomenon of Metals", by Georges Welter, six instalments, Jan.-June 1945, in *Metallurgia, The British Journal of Metals.*

APPENDIX[5]

Cost Efficiency of Light Metal Alloys

The designer of structures such as bridges and towers, solidly anchored to the earth, has but little if any interest in weight saving. His dominant criterion is cost.

A cost-strength evaluation of various metals may be expressed by means of simple formulae, which corresponds to the weight-strength evaluation we have expressed in terms of our Figs. 17, 18 and 19. Similar to Figs. 17 and 18, one of which expresses the strength per unit weight for tension, and the other gives the strength per unit weight for compression, we shall develop two formulae, one for strength per unit cost for tension, and one for strength per unit cost for compression.

Let the ratio of the cost per pound of light metal to that of a heavier metal be represented by n,

the ratio of the yield strength of heavy metal to that of a lighter metal by B,

the ratio of the weight of heavy metal to that of a lighter metal by C, and

the ratio of the modulus of elasticity of a heavy metal to that of a lighter metal by D.

Thus: for steel and aluminum $C = 3$ and $D = \frac{E_s}{E_a} = 3$;

for steel and magnesium $C = 5$ and $D = \frac{E_s}{E_m} = 5$.

The ratio of the cross-section of a light metal round bar to that of a heavy metal round bar, of the same length and cost, would then be $\frac{C}{n}$

Thus: $A_a = \frac{C}{n} A_s = \frac{3}{n} A_s$. (Equation 1.)

[5]The foregoing paper required a release from the U.S. Navy. This release was obtained. Since it was felt that neither the title nor text could subsequently be changed, the chapter on Cost Efficiency of Light Metal Alloys is offered as an appendix. Special acknowledgment is due Commander E. W. Conlon, U.S.N.R., for his unceasing interest, suggestions and co-operation.

A_s represents the area of a steel bar and A_a that of an aluminum bar.

Equating the strength of the heavy metal bar to that of the light metal bar, gives $A_s = \frac{A_a}{B}$. Substituting the ratio $\frac{A_s}{A_a}$ from equation 1, we obtain $n = \frac{C}{B}$ (Formula 1.)

Thus, in a comparison of cost-strength efficiency between a tension bar of steel and one of aluminum of the same strength ($B = 1$), the cost of aluminum would have to be less than three fold the cost per pound of steel.

Should we let B represent the ratio of strength of open-hearth steel to that of R 303 T aluminum, say 36000/72000 = ½, then n equals 6. A figure of either 6 or 5 is frequently offered as a cost ratio at which aluminum can begin to compete with steel. This, however, we believe to be very misleading for the following reasons:

(a) R 303 T and 75 ST aluminum may exhibit the greatest strength, they also command the greatest price.

(b) The deflection of aluminum structures is much greater than that of steel structures.

(c) The important factor of ductility is not included in the coefficient n.

(d) Last, but not least, the critical strength criterion should not be based on the tension properties of the material, but on the laws of behavior of this material under compression.

Basing our strength analysis on the compression rather than on the tension phenomenon, our reasoning proceeds as follows: For slender round bars of equal cost, equal length, and equal strength:

$$P_A = \frac{\pi^2 E_a I_a}{l^2} = P_s = \frac{\pi^2 E_s I_s}{l_s},$$

or $E_a I_a = E_s I_s$ or $I_a = \frac{E_s}{E_a} I_s = D\, I_s$.

Therefore, $\frac{\pi r_a^4}{4} = D \frac{\pi r_s^4}{4}$, from which it follows that

$$r_a^4 = D\, r_s^4. \qquad \text{(Equation 2.)}$$

From equation 1, we have $\pi r_a^2 = \frac{C}{n} \pi r_s^2$, or $r_a^2 = \frac{C}{n} r_s^2$.

Eliminating r_a and r_s between equations 1 and 2, we have

$$D = \frac{C^2}{n^2}, \text{ or}$$

$$n = \frac{C}{\sqrt{D}}. \qquad \text{(Formula 2.)}$$

Thus: for steel and aluminum $n = \frac{3}{\sqrt{3}} = \sqrt{3} = 1.73$,

and for steel and magnesium $n = \frac{5}{\sqrt{5}} = \sqrt{5} = 2.24$.

We believe Formulae 1 and 2 represent upper limits of cost ratio. In applying our analysis in some detail to the design of transmission towers we concluded that, even with a cost ratio of 1.73, aluminum cannot compete with steel on a strict strength-cost efficiency basis. Some of the reasons entering into this conclusion follow.

A transmission tower is a strictly utilitarian structure whose only function is to carry loads. Considering that the wind may blow from any direction and that it is unpredictable as to which cable, if any, may break, each member of the tower must be designed as a column. The column strength and limiting l/i ratios thus are of primary importance. If the tower is constructed of equal-legged angles, then another critical consideration enters, namely, that of the limiting b/t ratio (width over thickness ratio) of the legs of the angles. This limiting b/t ratio is primarily a function of the modulus, and of the limit design stress. It may be of interest to point out that the minimum thickness listed in the handbooks for 3 by 3 in. equal-legged open-hearth steel angle is ¼ in. Yet the structural steel companies that build towers extensively and successfully use 3 by 3 by ⅛ in. open-hearth steel angles, coupled with a limiting design stress of 36,000 lb. per sq. in. In the steel industry, these b/t proportions have been evolved as the result of decades of experience. This experience, as well as the necessary data for the design of limiting b/t ratios, either for aluminum or magnesium, is as yet not available, at least not available in sufficient detail to permit a limit design with a refinement such as has been evolved for steel. It is safe to conclude, however, that no 3 by 3 by ⅛ in. aluminum or magnesium angle could be used economically as a column. From this it naturally follows that, if, for example, we should want to replace a 3 by 3 by ⅛ in. steel angle leg of a limiting $l/i = 92$ and designed for a limiting stress of 36,000, we first would have to reduce the l/i to 54, which is the l/i corresponding to a limit stress of 36,000 in aluminum. Then we would have to select an angle with heavier leg. This would reduce the i and thus reduce the panel length of the tower leg still further. The leg thus would have to be braced at nearly twice as many points, which would run up the cost of the cross-bracing. In addition, the cross-bracing itself would require extra bracing. Further, shearing, punching, and other shop operations would have to be as cheap when working with aluminum, or magnesium, as it would be with steel, or else this item would act as a deterrent.

An aluminum or magnesium tower would be much more flexible and sway much more. This may not be serious, but neither can it be considered an advantage.

In view of the fact that Formula 2 was predicated on the behaviour of round bars in compression, and that by this means we side-stepped the bothersome factor of b/t ratios, we thus feel that the factor of cost ratio $n = 1.73$ for steel and aluminum, and that of $n = 2.23$ for steel and magnesium, represent upper limits which must be reduced before either aluminum or magnesium can compete with steel in the design of structures such as transmission towers in which strength is the dominant consideration and weight of only secondary significance.

CANADA'S NEW VOICE

Engineering Features of C.B.C.'s International Shortwave Station

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Introduction

The inauguration of the Canadian Broadcasting Corporation's International Service, early this year, has given Canada a new and powerful voice which will be heard around the world.

To more than half a million Canadians serving overseas, this new voice is the voice from home, the voice that cheers and brings new hopes. To the people of Britain and of the other Dominions, to the populations of the liberated countries it is the voice of a powerful ally which brings a message of friendship and goodwill. To our enemies it is the voice that will enlighten them on a way of life which has triumphed over their false ideology.

To all who listen, the voice of Canada had to be strong and clear, a reflection of the strength and virility of a young and powerful country. It is the purpose of this article to show how this strength and clarity was given to Canada's new voice by the application of the latest developments of communications engineering in the construction of the new C.B.C. shortwave station in the Maritimes.

History and Purpose

The establishment of the international service is a logical step in Canada's growing realization of its own importance in the world. As early as 1937 the C.B.C. urged the construction of a Canadian shortwave station. All House of Commons Special Committees on Broadcasting gave their strong support to this project as an undertaking to be financed by the government and carried out by the Corporation.

There were many reasons why this service was considered essential. Here are the principal ones:

First, until the vast contingent of our overseas forces has returned, Canada must alleviate their painful separation by serving them with stimulating news from home and cheerful entertainment of a Canadian character.

Second, Canada has something very definite to contribute to the organization of peace in the world as it has already done in the successful prosecution of the war; and radio has now become a recognized instrument in the field of national relations.

Third, as one of the leading countries in the world of trade, Canada must stimulate interest amongst other nations, by the wide dissemination of information on its cultural, political and economic life.

To accomplish this, Canada had to act quickly in order to keep the valuable shortwave channels still available to her or face the possibility of being permanently excluded from the already congested field of international broadcasting.

And so, on September 18th, 1942, the Canadian Government authorized the C.B.C. to proceed with the construction of a modern powerful shortwave transmitter and associated programming facilities.

Choice of Site

In planning a shortwave broadcasting service, the choice of the best possible location for the transmitting station is of paramount importance. This is particularly true in Canada because of its proximity to the north geomagnetic pole, which is the centre of a zone having relatively high absorption to radio waves. This zone, whose extent varies with solar, terrestrial-magnetic, and other forms of activity, covers in its quiescent state the greater part of our country, and radio waves passing through it are subject to undesirable transmission phenomena which result in greater fading, weaker signals, more erratic behaviour, and transmissions that are generally not as reliable as those which do not have to pass through this "disturbed area".

With this limitation in mind, preliminary studies were made in 1938 and showed that the best location for a Canadian shortwave station would be as far away from the zone of maximum absorption as was practically possible (see Fig. 1), the exact site chosen depending on the particular countries to be covered. This was confirmed in 1941 by actual measurements, which showed that the lower Maritimes gave improved results over other Canadian locations in transmission paths to Europe, Africa and South America.

Another important factor, in the selection of the optimum location of a station of this type, is the desirability of providing a large area of level land of high radio frequency ground conductivity for the erection of the antennae systems. This condition is necessary for maximum radiation efficiency. Finally the site must be easy of access by road or by rail, in a location where telephone lines, electric power and water supply are available.

The C.B.C. already had a standard broadcast station, CBA, near Sackville, N.B., on a site which met all these requirements. This point is, under quiescent conditions, well removed from the zone of high absorption.

The land is reclaimed salt water marshes providing excellent conductivity, and the location is easily accessible and fully provided with essential services. It was therefore decided to build the new station at Sackville and to merge the shortwave installation with the existing facilities, thus achieving considerable economy in operating costs, and taking full advantage of the experienced technical personnel already living in Sackville.

If the Tantramar marshes were ideal for the erection of the transmitting station, this region was entirely unsuitable for the programming and administrative quarters. Only in a large city was it possible to find together the linguists, the students of international affairs, the artists and the other specialists required for the production of programmes suited for an international audience. For this reason, the shortwave service studios were established in Montreal and the programmes are fed to the transmitters at Sackville via land-lines over a distance of approximately 600 miles.

The Transmitter Building

Since the shortwave station was to be merged with the already existing Sackville plant, it was necessary to construct a new and much larger building around CBA station, without interfering with its normal op-

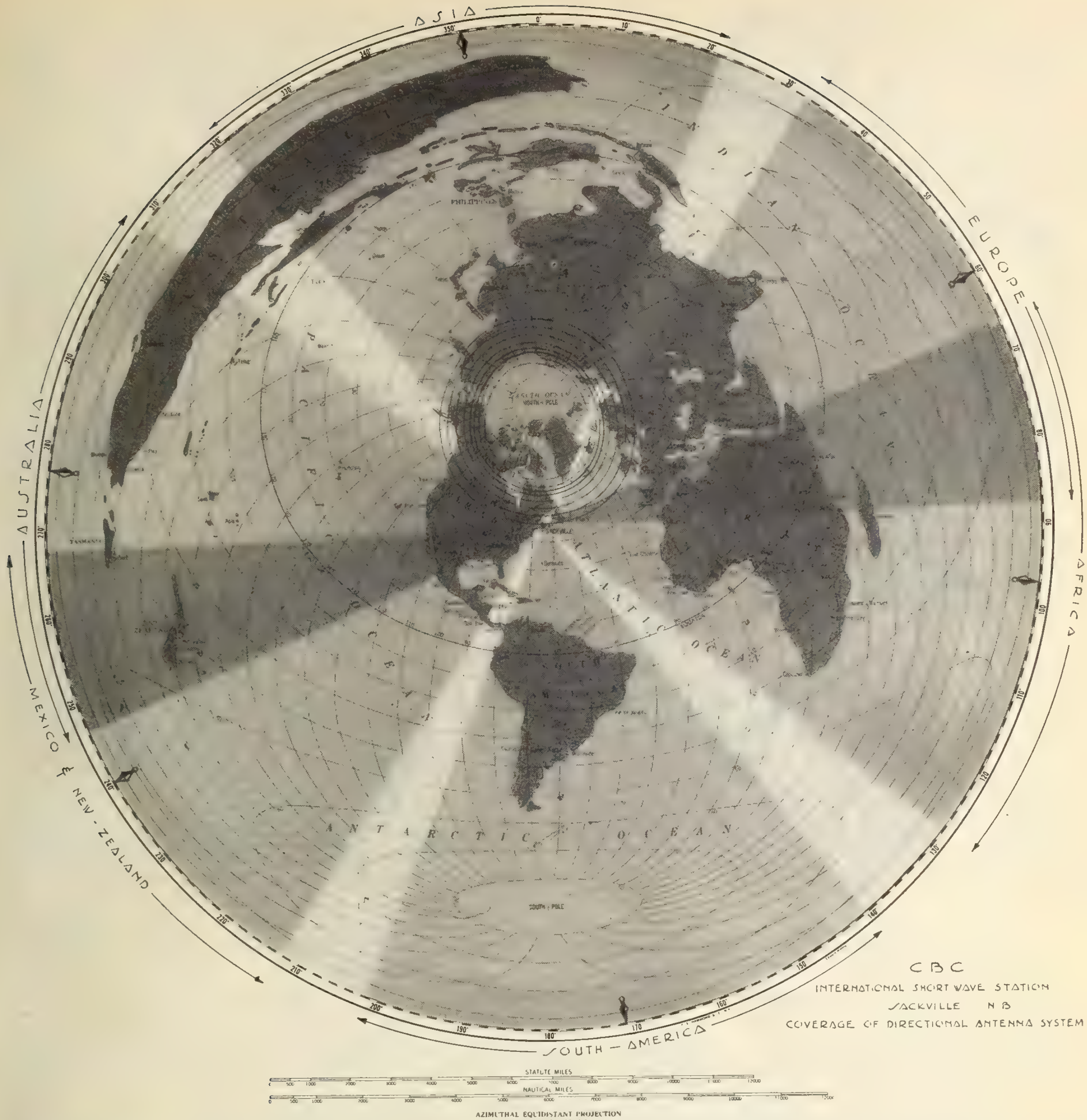

Fig. 1.—Azithumal projection of the world, showing the true direction of every point in the world from London. The bearing of any locality is indicated in degrees from the North on the peripheral protractor by the extension of the straight line joining that point and Sackville. This map also shows the directions of the various International Service transmissions.

eration. Thus, the new plant is not merely an extension to existing facilities but rather an integral structure in itself, designed to enclose the old station as well as the new shortwave transmitters and accessory facilities.

The building is a modern two and a half storey structure of reinforced concrete. The layout of the main floor is shown in Fig. 2. The main equipment, for the two shortwave transmitters and for station CBA, is installed in separate rooms, on each side of the main control room, which is 120 ft. long and 40 ft. wide. The transmitters are so mounted that their front panels form the separating wall between the transmitter rooms and the main control room.

On the same floor, at the rear of the building, are found the antenna switching room, the electric power control room and the standby power supply enclosure. In the right section are located the programme and line control facilities, the master control and recording rooms, CBA talk studio and three separate control booths. An office section at the front completes this floor. Future expansion is possible by extending the building on the left, thus lengthening the main control room and providing space on each side of it for additional transmitter units.

On the ground floor are located the transformer vaults, boilers, water cooling and ventilation systems, the laboratory and the maintenance shops as well as additional offices and complete staff quarters. These quarters, which are absolutely necessary in case the station is isolated by inclement weather for any length of time, provide sleeping accommodation, kitchen facilities and other living conveniences for an emergency

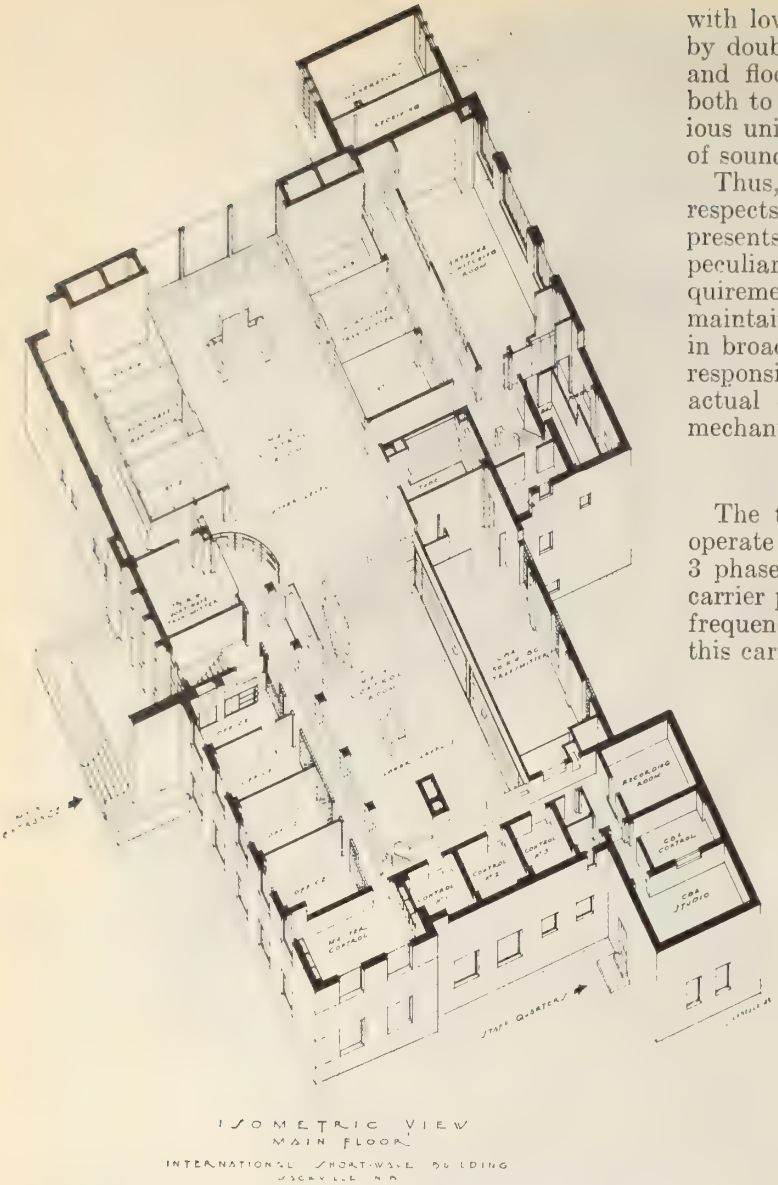

Fig. 2—Isometric view of the main floor of the Sackville transmitter building.

staff of six. A low mezzanine floor over certain parts of the building provides additional storage as well as access to fan rooms and ventilating ducts.

The exterior wall is of waterproof cement stucco, selected to resist driving rains, and divided into panels to give scale to the design and so that, if cracks occur, only the panels affected need be repaired. The interior partitions are of glazed tile to reduce maintenance. The ceilings are of Transite, fastened with screws so that, if any changes are necessary in the concealed wiring, panels may be removed and replaced without damage.

The presence of strong radio frequency fields around the transmitter equipment made it necessary to take special precautions to prevent induction currents in the concrete reinforcement steel and in all other metallic parts of the station, such as pipes, ducts, conduits etc. This is accomplished by a very thorough grounding system. Before concrete is poured in the forms, all reinforcing rods are electrically welded together at all intersections and the resulting mesh is connected to the common ground system by heavy copper straps located every ten feet.

In addition, all studios and control rooms, equipped with low level audio circuits, are completely shielded by double copper screening built in the walls, ceilings and floors. This section is also acoustically treated both to provide necessary insulation between the various units, as well as proper absorption and reflection of sound for faithful reproduction.

Thus, it is seen that, although conventional in many respects, the construction of a building of this type presents interesting and sometimes complex problems peculiar to its functions. Because of its special requirements, it has been necessary for the C.B.C. to maintain its own staff of architects, who, as specialists in broadcasting construction, were entrusted with the responsibility for the complete design and for the actual construction of this building and associated mechanical equipment.

Transmitters

The two shortwave transmitters were specified to operate from a primary power supply of 2300 volts, 3 phase, 60 cycles and to deliver at least 50 kw. of carrier power into a 600 ohm transmission line on any frequency between 6 and 21.75 megacycles per second; this carrier power to be capable of full modulation by any audio frequency in the range between 30 and 10,000 cycles per second.

The engineering specifications, developed by the Plant Department of the C.B.C., which was responsible for the radio and electrical construction of this station, required further that the stability of the transmitters on any of its operating frequencies be kept to within ± 5 parts in 100,000 by means of thermostatically controlled quartz crystals.

The overall audio frequency characteristics, from the line input to the transmitter output, were specified to be flat within two decibels between 30 and 10,000 cycles per second, with a total harmonic content not to exceed 5 per cent of fundamental within that frequency range up to full transmitter modulation. The total unweighted noise or cumulative residual modulation on the carriers was required to be at least 50 decibels below 100 per cent modulation.

Transmitters meeting these specifications were supplied by RCA Victor Company, Ltd., on a competitive basis. A very much simplified diagram of the circuits of this transmitter is shown in Fig. 3. It will be noted that there are four stages of radio frequency amplification between the crystal oscillator and the final output stage. This power amplifier uses two Type 880 tubes connected push-pull in a high efficiency (70 per cent) Class C circuit. Amplitude modulation of the carrier is accomplished in the plate circuit, using a Class B modulator driven by 3 stages of audio amplification in cascade. Negative feedback is used in the audio system to ensure linearity of amplification.

The final amplifier operates at 10,000 volts DC with a current of 7.1 amperes. This power is supplied by a hot cathode mercury vapour, 3-phase, full wave rectifier, using six Type 857-B tubes. Operation of the transmitter at reduced power can be obtained by changing the primary connection of the rectifier transformers from delta to star.

There are no motor-generator sets or rotating power apparatus and the station is entirely AC operated. The power input to each transmitter at full load, with average programme modulation, is approximately 135 kw. All transmitter tubes, except the 880's of the RF amplifiers and of the modulators are air cooled. These latter are water cooled, using a closed distilled water system designed to reduce water losses to a minimum. Approximately 5000 gallons of water are recirculated through the system every hour, dissipating 450,000 b.t.u. per hour. In addition, each transmitter enclosure is ventilated by a central cooling system.

The transmitters proper, including radio and audio frequency units, rectifiers, switches, relays and other components are located in separate rooms 36 ft. wide by 16 ft. deep, on each side of the main control room. The main power transformers, the modulation transformer and reactor, the voltage regulators and the water cooling equipment are located on the ground floor below the transmitters proper.

In the mechanical design and layout of the equipment, special precautions were taken to facilitate maintenance and to ensure safety in operation. While the distribution of the various units allows full observation of essential components in operation, the danger of electric shock to personnel is reduced to a minimum. This protection is provided by a system of interlocks which removes all dangerous voltages and grounds all DC circuits when the doors giving access to any high voltage compartments are opened.

Protection to equipment is provided for by time delay relays, which prevent application of bias or plate voltages to rectifiers or power tubes until the filaments have been properly heated, also by high speed overload relays in the plate circuit of power tubes and in the primary of the rectifier transformers.

The transmitters may be started manually with individual control switches or automatically by throwing a master switch. This operates a series of time-delay relays which provides the necessary interval sequence in applying voltages on the various elements of the circuit.

Aerial Systems

Before we discuss the aerial system of the new station, it will be helpful to examine the general problem of international coverage.

In the first place, because of language and cultural differences between nations, every country to be served calls for its own particular programme service. Were it desirable to maintain this service on a more or less continuous basis throughout each day for each individual country, there would be needed as many transmitters and aerial systems as there are countries to be covered.

Fortunately, however, continuity of service is not at all essential. In practice it has been found that it is sufficient to transmit to any particular country for a short period, say one or two hours each day, or even less, if this period is chosen at a convenient hour for the local listeners. Because of the difference in longitude of various countries and the resulting local time difference, a single transmitter can be kept in continuous operation throughout the day, hopping from one country to another in such a way as to serve each country at a time convenient for reception. So, in international broadcasting, the time zones of the world are actually a blessing in contrast to the serious difficulties which they introduce in operating a national network in a country the size of Canada.

Directional Arrays

Having determined that because of culture, language and time differences, the international transmitter can best operate by serving one country at a time, it is obvious that best results will be obtained by concentrating the radiated power in the direction of the particular country to be served. This is accomplished by using directional antenna arrays, which can be designed for practically any amount of concentration desired much in the same way as mirrors and lenses

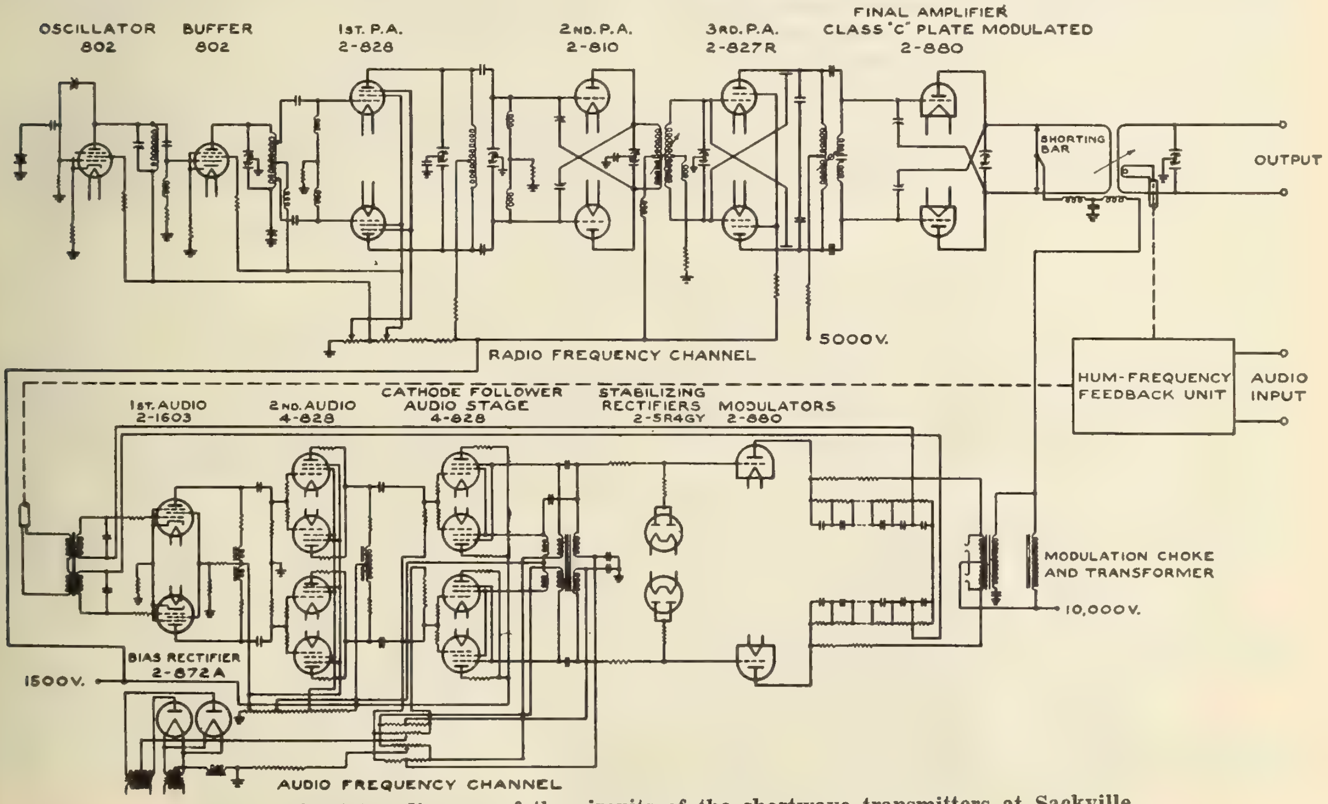

Fig. 3.—Simplified diagram of the circuits of the shortwave transmitters at Sackville.

can be used in a searchlight. The greater the concentration or the higher the directivity of the system, the smaller the area covered, but the stronger the signal in that area.

Unlike the searchlight, however, these arrays are of such dimensions that they cannot usually be moved physically to alter the direction of the beam.

By resorting to electric reversal and slewing of the beam direction, it was found possible to cover from Sackville practically all parts of the world with relatively high concentration, using only three sets of directional antennae. The European beam which is reversible to serve Mexico, Central America and New Zealand, has five separate arrays. The African beam, which is reversible to serve Australia and New Zealand uses three separate arrays. The South American beam also uses three separate arrays and is reversible to Asia and part of Australia.

Reference to the azimuthal projection of the world given in Fig. 1 shows how these three beams, in their forward and reversed positions, can provide service to practically the whole world while concentrating their maximum energy on the most important targets of our Canadian service.

The type of array used at Sackville was selected on the basis of a critical study of the relative performance and cost of the various antennae systems used both on this continent and in Europe. This investigation, undertaken by the Transmission & Development Department of the C.B.C., which was responsible for the design and construction of the antennae of this project, clearly brought out the overall superiority of multi-element curtains of the resonant type over the simpler and cheaper non-resonant types such as the horizontal rhombics which are found in many installations.

Table A gives a description of the arrays used at Sackville while Fig. 4, illustrates the actual form of construction of a typical array. In this figure, for sake of clarity, the radiating elements of the front curtain have been indicated by heavy lines. It will be seen that in this curtain there are four vertical stacks of four horizontal elements. Each one of these elements has an electrical length of one half wavelength. The vertical spacing between elements is also one half wavelength. All four dipoles in a vertical stack are fed in phase by means of a transposed two-wire feeder.

In a system such as this, the number of elements in the horizontal plane determines the horizontal directivity, while the number of elements in the vertical plane determines the vertical directivity. Finally the height of the first row of horizontal elements above ground controls in some measure the vertical angle of radiation.

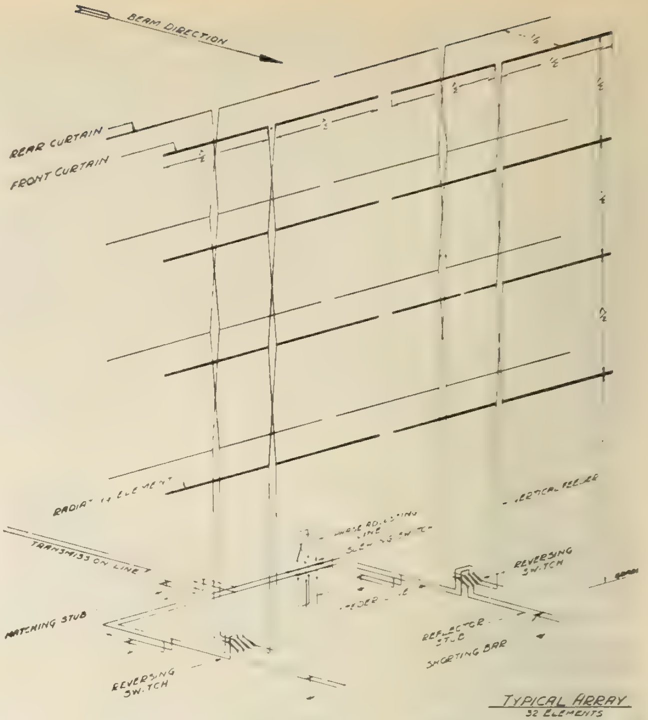

Fig. 4.—Typical array with two curtains, each with 16 elements. This figure also illustrates method of feeding, reversing, slewing and stub matching.

As a matter of interest, Figs. 5, a, b, c, show horizontal polar diagrams of radiation for systems of 1, 2 and 4 elements respectively. These diagrams illustrate clearly the important concentration of energy provided by multi-elements systems. The stacking of elements in the vertical plane has a similar effect on the vertical dimension of the beam.

Reversing and Slewing

The same figures also reveal that the radiation pattern of arrays consisting of a single vertical curtain is symmetrical on each side of the plane of the curtain, with equal radiation both in the forward and backward directions.

TABLE A

DESCRIPTION OF SHORTWAVE AERIALS AT SACKVILLE

Aerial System	Frequency Band (in megacycles)	Bearing of Beam	Number of Horizontal Elements	Number of Vertical Stacks	Height of Lower Elem. Above Ground (in wave-lengths)	Beam Width (in degrees)	BeamGain (in decibels)	Slewing Angle (in degrees)	Vertical Radiation Angle (in degrees)
European	17	N60°E	4	4	1	35	21.5	±10	7.5
	15	N60°E	4	4	1	35	21.5	±10	7.5
	11	N60°E	4	4	1	35	21.5	±10	7.5
	9	N60°E	4	4	1	35	21.5	±10	7.5
	6	N60°E	4	3	1	35	19.5	±10	9
African	15–17	N97°E	4	2	1	35	15.3	±13	11
	9–11	N97°E	4	2	1	35	15.3	±13	11
	6	N97°E	4	2	½	35	12.6	±13	17.5
South American	15–17	N171°E	4	2	1	35	15.3	±13	11
	9–11	N171°E	4	2	1	35	15.3	±13	11
	6	N171°E	4	2	½	35	12.6	±13	17.5

Since it is extremely unlikely that any programme would be simultaneously directed to two separate countries located in opposite directions, the back radiation is lost energy in such a system. Figure 5d shows how the use of a reflector makes it possible to utilize the back energy to reinforce the radiation in the desired direction. Another important advantage of the reflector is that it eliminates the possibility of echo at the receiving end. This echo would be due to the difference between the time taken by the back and front waves to reach the receiving point over unequal distances in opposite directions around the world.

As may be seen in Fig. 4, the reflectors used at Sackville are identical to the radiators and comprise the same number of elements, so that it is possible to interchange the two by means of a switch, thus reversing the radiated beam by 180 deg. in the horizontal plane. Furthermore, these arrays are all arranged for slewing or changing the direction of the beam by a limited amount on either side of its normal position. This is done by shifting the phase of the current in the two vertical bays of the radiating curtain.

Frequencies

Since this type of array uses resonant radiators and reflectors, the actual dimensions of each element is a function of frequency. Because of this, each array can be used efficiently only over a narrow band of frequencies. The Canadian shortwave station uses 11 frequencies as shown below with corresponding call letters:

List of Call Letters and Frequencies

CKOB	6090 kc.
CHAC	6160 kc.
CHLS	9610 kc.
CKLO	9630 kc.
CHMD	9640 kc.
CKXA	11705 kc.
CHOL	11720 kc.
CKCX	15190 kc.
CHTA	15220 kc.
CKNC	17820 kc.
CHLA	21710 kc.

The European beam uses five distinct arrays as already described; one array for each of the five frequency bands of 6, 9, 11, 15, and 17 megacycles. This permits maximum efficiency of radiation towards Europe for any of the frequencies used. In the African and South American aerials, only three separate arrays are used; one for 6 mc., one for 9 and 11 mc., and one for 15 and 17 mc.

Beam Width and Gain of Arrays

Table A gives a summary of the electrical construction, directivity and gain of all arrays. Because of its greater number of elements, the European beam provides the highest gain, approximately 20 decibels as compared to a single half-wave doublet located one half-wave above ground. This corresponds to a hundredfold increase in radiated power in the direction of Europe. In other words, to obtain the same signal strength in Europe with a non-directional antenna, the power at the transmitter end would have to be increased 100 times, or to 5,000 kw. instead of 50 kw.

Even if such power output could be attained in a practical design, the annual operating costs alone for such a station would pay in a few weeks for the larger original investment in a high gain directional system. The gains of the African and South American beams are not quite as large, varying between 12.6 and 15.3 decibels, or providing an average equivalent power increase of approximately 25 times.

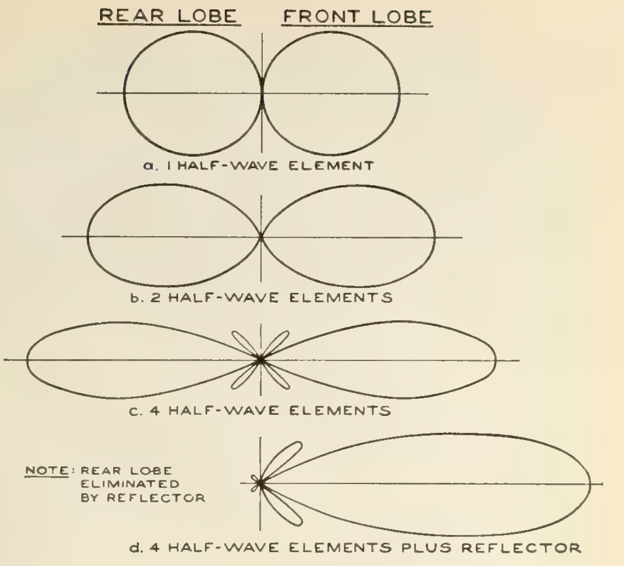

Fig. 5—Horizontal polar diagrams of radiation pattern of various types of arrays.

The width of the various beams is approximately the same for all directions and frequencies, that is 35 deg. for one half maximum field intensity. This means that points located in a direction of 17½ deg. on either side of the beam axis will receive half the intensity of the signal present at the centre of the beam. This situation can be improved, if necessary, by slewing the beam on one side or the other, as all arrays at Sackville are slewable on both sides by at least 10 deg.

Vertical Angle of Radiation

Long distance radio transmission is made possible by the reflection of radio waves from the ionosphere, which is a region of partially ionized gases in the upper atmosphere. This region extends from approximately 30 to 250 miles above the earth. The ionization is used by the ultra-violet radiation from the sun and as a result varies with the diurnal, seasonal and sunspot cycles of that body.

When the degree of ionization reaches a critical value, which varies with the frequency and the angle of incidence of the radio wave, refraction takes place and the waves are bent back towards the earth. The surface of the earth or of the sea, as the case may be, in turn reflects the waves back towards the ionosphere where the process is repeated. This form of propagation is illustrated in Fig. 6, which shows how transmissions from Sackville actually reach Europe on certain frequencies after making two distinct hops. This drawing also illustrates the importance of choosing the correct vertical angle of radiation of the beam in such a way as to concentrate a maximum amount of energy on the area to be served after successive reflections between the ionospheric layers and the earth.

The frequency to be used for any particular service varies with the distance to be covered, the hour of the day, the season and the year. It is for this reason that antenna arrays are provided at Sackville for operation on five separate frequency bands which are chosen for optimum results on the basis of calculations and predictions made months ahead of time.

Layout and Construction of Aerial Systems

Figure 7 is an aerial perspective of the shortwave station with the various antennae arrays, transmission lines, transmitter building, etc., all shown in their proper relation to one another and to the town of Sackville which appears in the background.

An idea of the dimensions of the arrays may be had by comparison with the size of the electric power line in the foreground or with the CBA vertical radiator in the centre of the picture, which has a height of 460 ft.

As already described, the orientation of each aerial system is determined by the direction of the country to be served while their exact location has been chosen in such a way as to minimize any masking effect which one system might have upon the other.

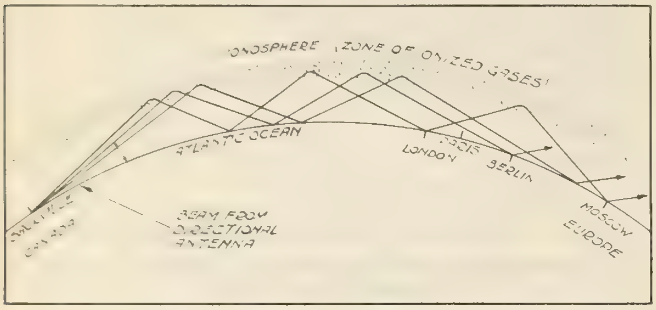

Fig. 6.—Propagation of short waves showing how transmissions from Sackville actually reach Europe on certain frequencies after making two or three distinct hops.

As to the actual design of the aerial structures, it will be sufficient to describe the European system which is of greater interest because of its more elaborate construction and higher gain. Its five separate arrays have a total length of 1220 ft. and are supported between four steel towers. Two of these towers are 379 ft. high, one is 217 ft. and the fourth 165 ft. The 6 mc. array is supported between the two highest towers while the 9 and 11 m.c. arrays are hung between the second and third towers and the 15 and 17 mc. curtains are between the two lower towers.

The towers are of lattice steel construction of uniform cross section, six feet square. The multi-element curtains are supported by steel messenger cables, running between the towers. The spacing between the messengers and between the curtains which they support, is maintained by specially designed spreaders, also of lattice steel construction. Steel cables of various sizes are used as stays at the ends and in intermediate positions on each curtain, also as bracing between curtains, to provide in all elements the tensions necessary to maintain them in proper spatial relation. All steel cables, except the tower guys, are broken into short electrical lengths by means of insulators to prevent absorption or reflection of the energy radiated by the arrays.

The messenger cables are attached to halyards, between $1\frac{3}{8}$ and 2 in. in diameter, which run over large sheaves at the top of each tower and continue down inside the tower structure to suitable counterpoises weighing between 36,000 and 57,000 lb. This construction ensures the necessary rigidity in the curtains while protecting them against overload under unfavourable wind conditions.

The towers rest on tapered reinforced concrete bases, the largest of which measures 19 ft. by 19 ft. by 11 ft.

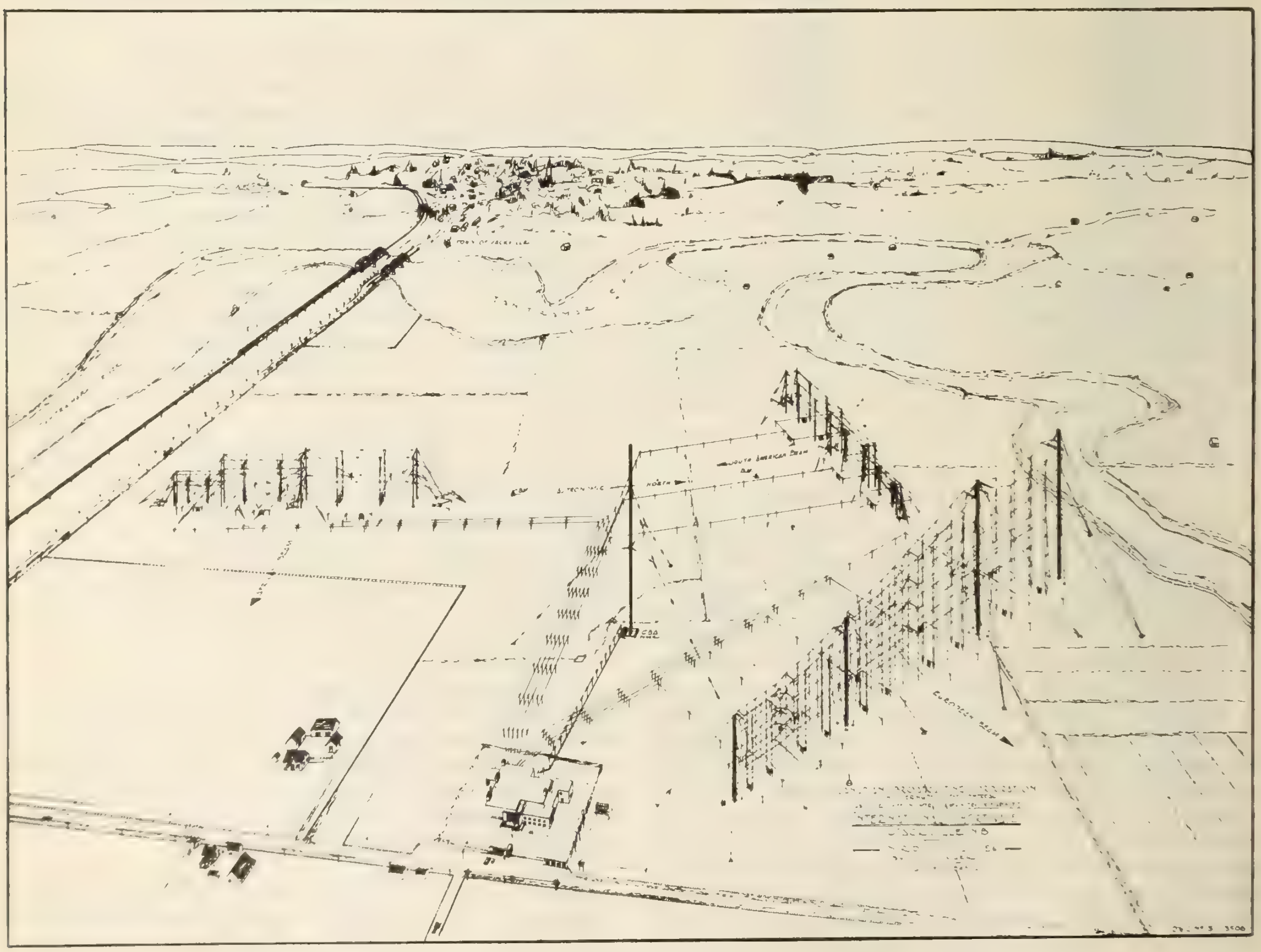

Fig. 7—Bird's-eye view of International Shortwave Station at Sackville.

6 in. and weighs 185 tons. The guy anchors are also of reinforced concrete.

The elements of the curtains and the feeders are of 1/0 AWG stranded copper cable with copperweld core, assembled with galvanized steel and bronze fittings specially designed to minimize the danger of corona which constitutes a special problem at the frequencies and voltages used.

The whole system, including both the towers and the curtains, was designed with a minimum factor of safety of three to meet a wind pressure corresponding to an indicated velocity of 120 mi. per hr. and an ice coating of ½ in. thickness on all members.

The African and South American systems are of somewhat similar construction, using spliced wooden masts between 85 and 165 ft. in height.

Transmission Lines and Feeders

Each separate array is fed by its own transmission line. These eleven lines are of the balanced open wire two conductor type, with 20 in. spacing. They are supported by hanging insulators from wooden poles erected every 100 ft. The conductors are of 1/0 AWG stranded copper cable with steel core. The transmission efficiency of these lines varies with length and frequency. It is 87 per cent at 17 megacycles on the 2,350 ft. line to the African system, while it reaches 96 per cent for the 17 megacycle, 700 ft. line to the European system.

All lines have a characteristic impedance of 552 ohms, except near the transmitter building where each line tapers to 6 in. spacing, giving an impedance of 415 ohms which matches the output network of the transmitters. There are no coupling networks used to match each line to its antenna system. Instead, the correct impedance is obtained by means of short sections of transmission line or stubs. One end of the stub is connected to the main transmission line, at a position determined from standing wave measurements, and the effective length of the stub is adjusted by means of a short bar until the proper impedance is obtained.

As illustrated in Fig. 4, sections of lines of the proper electrical length are also used to maintain the correct phase relationship between all elements of a curtain as well as between the front and rear curtains for both directions of the beam.

Each array may be reversed or slewed either side by remote control from the main transmitter room by means of motor driven switches, mounted in weatherproof enclosures, erected on poles at the base of each array.

Either of the two transmitters can be connected to any one of the eleven transmission lines by means of manually operated four pole, double throw switches of special design, assembled on frames in the antenna switching room at the rear of the transmitter building. In order to obtain low contact losses, these switches are provided with silver plated copper blades and spring contacts.

Audio and Control Facilities

For normal operation, the programmes of the International Services are fed to the Sackville station by wire lines from Montreal or from other C.B.C. studio points. As a measure of protection, however, in case of line failure, and also to provide greater flexibility in special circumstances, sufficient studio facilities have been provided to permit programme originations from the transmitter station itself. A small studio may be used for instrumental programmes, recitals, dramas and so forth, while two talk studios, one normally associated with each transmitter, are available for local announcements, news and recorded programmes.

The recording room is fitted with four high quality acetate recording machines, which may be used to transcribe programmes, from the C.B.C. domestic networks or from the shortwave feeds, for delayed broadcasting at a convenient listening time over the shortwave transmitters. In the recording room are also located the film recorders, which keep a continuous reference record of all material transmitted by the station.

To ensure maximum flexibility in the control of the incoming and outgoing circuits of the studios, recorders and transmitters, all such circuits are terminated in a master control position. This room is equipped with a six channel preset type control console, monitoring and testing facilities, and automatic telephone system, thus permitting the centralized supervision and co-ordination of all feeds and operations.

Performance of Station

At the time of writing, the aerials of the African and South American beams are not yet completed and transmission in those directions will probably not start until late summer. Transmissions to Europe, however, have taken place daily since December 25th, on an experimental basis until February 25th, when the regular service was inaugurated. The reports on these transmissions have been most encouraging, indicating excellent reception in all parts of Europe.

Official reports from the monitoring service of the British Broadcasting Corporation indicate that the signal strength, in England, of the new Canadian station is the highest of all shortwave stations on this side of the Atlantic, with an average of 400 microvolts per metre as compared to 200 microvolts per metre for American stations received at the same location in England. The same reports indicate that the fading on the Canadian transmission is very moderate and that the programme quality is excellent. This superior performance is undoubtedly due in great part to the advanced design of the aerial system of the Sackville station.

Acknowledgment

The author wishes to thank the Chief Engineer of the Canadian Broadcasting Corporation, Mr. G. W. Olive, for his permission to publish this broad outline of a project which was carried out under his direction by all departments of the Engineering Division.

CANADA'S PULP AND PAPER INDUSTRY
Past and Future

R. L. WELDON, M.E.I.C.
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Paper presented before the Montreal Branch of The Engineering Institute of Canada on April 5th, 1945

In 1844, just over one hundred years ago, a man named Charles Fenerty, a Nova Scotian, wrote to the *Acadian Recorder*:

"Enclosed is a small piece of paper, the result of an experiment I have made in order to ascertain if that useful article might not be manufactured from wood. The result has proved that opinion to be correct, for — by the sample which I have sent you, gentlemen — you will perceive the feasibility of it. The enclosed, which is as firm in its texture, as white, and to all appearances as durable as the common wrapping-paper made from hemp, cotton, or the ordinary materials of manufacture, is actually composed of spruce wood reduced to a pulp, and subjected to the same treatment as paper is, in course of being made, only with this exception, viz: my insufficient means of giving it the required pressure. I entertain an opinion that our forest trees, either hard or soft wood, but more especially the fir, spruce, or poplar, on account of the fibrous quality of their wood, might easily be reduced by a chafing, and manufactured into paper of the finest kind. This opinion, sirs, I think the experiment will justify, and leaving it to be prosecuted further by the scientific or the curious, I remain, gentlemen, your obedient servant. . ."

Working independently of contemporary experiments in Europe, Fenerty was the first man to produce ground wood pulp on this continent and to fabricate the pulp into paper. He can be considered the father of Canada's greatest industry.

We were slow to take advantage of Fenerty's discovery. It was not until the year before Confederation, 1866, that Alexander Buntin installed at Valleyfield, Que., the first commercial wood grinder to appear in Canada. In the same year, Angus Logan built the first chemical wood-pulp mill in Canada at Windsor Mills in Quebec.

During the next decade, the use of wood-pulp was extensively developed and, in 1887, Charles Riordon installed the first sulphite mill in Canada, at Merritton on the Niagara Peninsula.

From these early beginnings the manufacture of cellulose pulps from wood was to grow, within a man's lifetime to be the largest industry in Canada.

The Industry

There are four major processes by which wood is converted into pulp. The mechanical or groundwood process, with which Fenerty experimented, consists of pressing the pulpwood log against a revolving grindstone constantly washed by a stream of water.

In each of the other three processes the pulpwood log is first reduced to small chips and then "cooked" with the chemicals appropriate to each process in large digesters. The products are sulphite, soda and sulphate pulp, and kraft pulp, respectively.

These four pulps, either singly or in combination with each other, are the raw materials for making paper and board from wood. In addition, there is an ever-growing list of new materials in fields such as rayon, cellophane, explosives and plastics, which are being manufactured from these pulps.

Nor are all papers in Canada made from wood-pulp. There are mills in Canada today engaged in the ancient art of papermaking from cotton and linen rags. But they have adopted modern methods and their work is an important part of the industry. From these mills comes the paper for bank notes, admiralty charts and types of paper where the requirements are very exacting.

Cigarette papers were formerly made from linen rags, chiefly collected in the countries of western Europe. When war cut off this supply, Canada began production of cigarette papers made from flax fibre grown in Canada. We are now independent of other sources for this type of paper.

More than a hundred pulp and paper mills operate in Canada. They are owned by eighty companies spread across Canada from the Atlantic to the Pacific.

No one company dominates any single field in the industry. They are independent and non-interlocking. In most of them, the stock is widely held by Canadians. For example, in the case of our own company there are over 4,000 shareholders, with an average holding of about 100 shares each, or about 5 shareholders for each year-round employee.

The position of the industry and its importance to our country is shown in Fig. 1, which gives statistics of the leading manufacturing industries of Canada, based on the five-year period before the war.

The chart was prepared by the Canadian Pulp and Paper Association from data of the Dominion Bureau of Statistics.

From the first diagram it will be noted that the capital invested in the pulp and paper industry is almost 3½ times as large as the capital invested in the next leading industry, non-ferrous metal smelting and refining.

The next diagram shows that the pulp and paper industry surpasses all other industries except sawmills in the employment of men. Its figures include only those actually employed in the mills. If labour in the woods and in power plants subsidiary to the mills were included, the industry would show at peak employment about 100,000 workers on its payrolls.

On this basis some half million Canadians obtain their livelihood from the industry. A moment's reflection will show its far-reaching effect on our national economy from the point of view of employment.

From the bottom diagram it will be seen that the industry led in wages and salaries. It happens that the next industry is printing and publishing, basically dependent on the paper industry.

In the production of hydro-electric power, Canada holds an outstanding position. The needs of the pulp and paper industry have greatly helped to produce this result.

In pre-war years, the industry was by far the largest single user of electric power, consuming 54

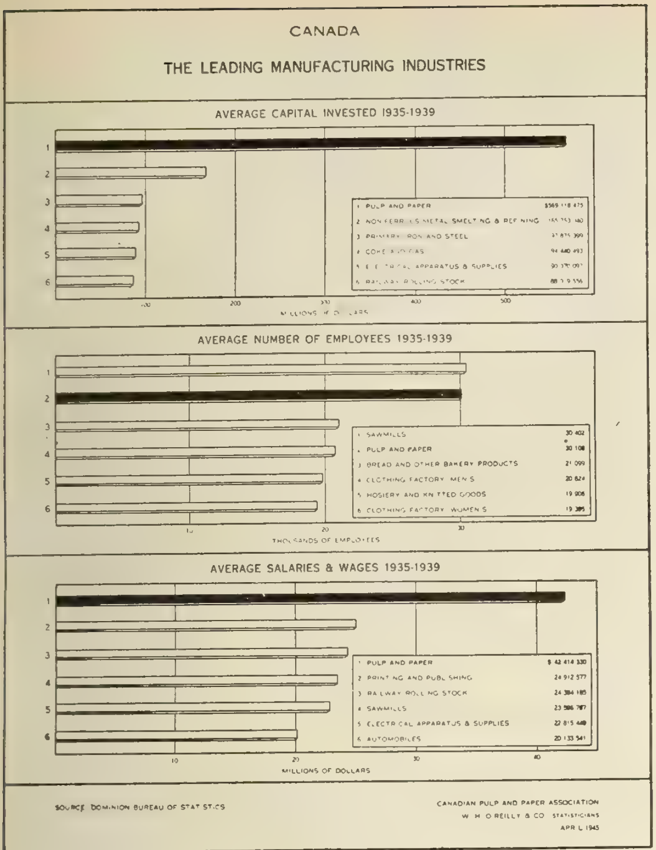

Fig. 1

per cent of the total used by all Canadian manufacturing industries including mining.

Canadian designed and Canadian built pulp and paper machinery is among the best in the world and most Canadian mills are equipped with it.

The following figures indicate the extent to which other industries contribute to the production of pulp and paper.

For transportation, $60,000,000 a year;
Pulpstones, $400,000;
Cylinder and Fourdrinier wires of copper, $1,-400,000;
Felts from the textile mills, $3,000,000;
Rags and waste paper, $5,000,000;
Repair parts, $6,000,000.

Items and sums of money too numerous to mention are exchanged with virtually every type of supplier in the Dominion.

To trace the growth of this industry over the last quarter century reference may be made to Fig 2, a chart of "Pulp and Paper Production."

Considering first the group of curves illustrating Canadian production, the top curve shows that pulpwood production increased from roughly 3 1/3 million cords in 1917 to about 8¾ million cords in 1943. (In this connection it should be noted that pulpwood figures are shown in cords — not tons as might be implied from the chart.)

The broken line represents Canadian consumption of puplwood, the difference between these two curves being exports of the raw material.

The heavy black line indicating "Total Pulp" production rises from a figure of about 1.6 million tons in 1917 to 5.25 million tons in 1943, an increase of over 3 to 1 in the quarter century period. This reflects the amazing development in Canadian mill capacity between the period of the two wars.

Total paper and newsprint production are shown by the two curves immediately below total pulp. The difference between total pulp and total paper represents pulp shipped to conversion mills, the majority of which are in other countries.

The difference between newsprint and total paper is represented by the production of other papers in Canada, the details of which are shown in the lower curves.

Ease of distribution brought about by increased transportation facilities, the development of rural free deliveries and the concentration of population in urban areas have all tended to increase newspaper sales and to swell our export sales of newsprint to meet increasing world demand.

It is estimated that paperboard used during this war for packaging of materials has substituted for 2 billion feet of lumber. This and the additional labour which would have been required to convert lumber to boxes as compared with the highly mechanized processes of manufacturing paperboard containers has enabled us to divert thousands of men to the armed forces or to more useful tasks.

The Forest and Forest Policy

The whole basis upon which the pulp and paper industry rests is dependent upon its supply of raw material—pulpwood. Its future prosperity requires the assurance of a definite, continued, adequate and economic supply of pulp wood.

In this, the Canadian industry is fortunate, for it is possessed of a supply of this raw material, adequate to meet its current demands and to provide for its reasonable future growth. Good management, conservation for use and sound protection will enable the nation to look to the future with confidence in the industry's ability to survive and develop.

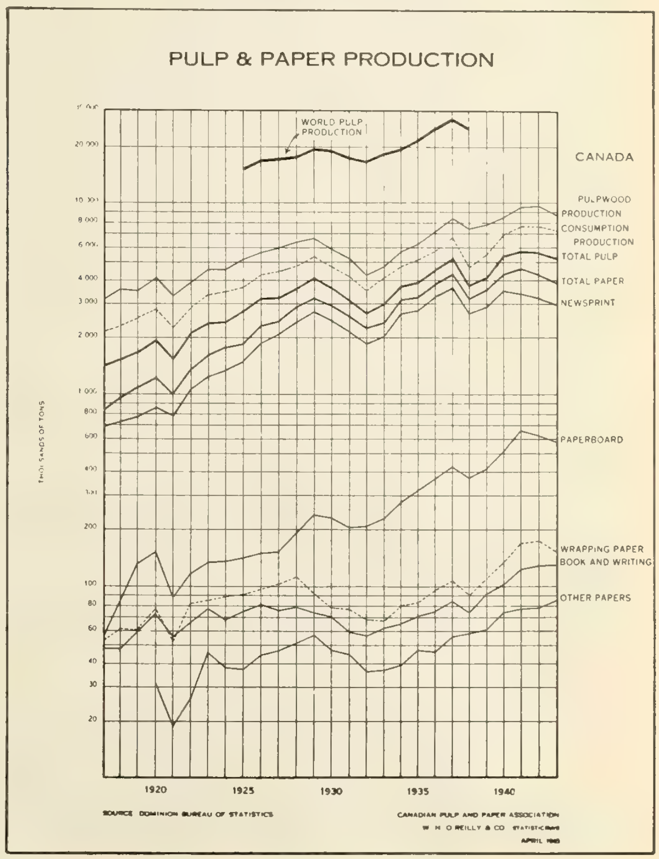

Fig. 2

Canada's productive forests comprise over ¾ of a million square miles. Of this productive area, about 430,000 square miles are at present accessible, but, what is inaccessible forest today, may become accessible tomorrow as roads are built into the wilderness and methods of transportation improve.

Operations for the cutting and delivery of pulpwood to the point of consumption have changed but little over the years. Most pulpwood is cut in four foot lengths now, in order to bring more forest area within commercial range. Small brooks can be driven more easily with the four foot wood. Horses are still the basic medium of transport to the nearest stream although the use of tractors for longer hauls is becoming more common. Where the distances are not too great and areas not easily accessible by stream, motor truck delivery is used. Nothwithstanding the marvellous advance of engineering in industry our methods of harvesting wood have made little progress. This is due partly to the nature of the operation and partly to the lack in the past of economic necessity for change. The cutting of trees scattered over a forest area of varying terrain does not lend itself easily to mechanized mass production methods.

Here, indeed, is an opportunity for the engineer.

Let us now review the policy of the industry toward the forest. There is widespread opinion that the industry devastates the forest or exploits it without regard to the future.

Many people seem to look upon tree cutting as an almost criminal practice. But the industry is not engaged in cutting the old pine trees from people's homesteads or in felling shade trees in our village squares. The useful forests of Canada, like the wheat land of the west can be cropped and grown and cropped again. The only essential difference is the time of growth.

If used wisely our forests will serve us in perpetuity. No one understands this better than the operators of the pulp and paper industry, for their livelihood depends on the continued supply of accessible pulp wood. A mill is generally situated in such a location that a nearby body of water and its tributaries will serve as the means of transport, a basic requirement for economic production. The cost of drawing pulpwood from beyond the watershed in which the mill is situated makes its use almost prohibitive. Paper mills cannot be moved easily. Thus no single mill has at its command an unlimited forest area from which to draw its raw material, and conservation for use must be the keynote of its economy.

Conservation for use is effected in three main ways: by reforestation—by protection of the forest from fire, disease and insect pests — and by good forest management.

Reforestation is often taken to mean only tree planting, a serious error. Any measure which assists a forest to re-establish itself after cutting, fire or insect damage is reforestation. Tree planting in this country is a relatively minor effective measure.

Care in harvesting the wood so that nature will have its opportunity of growing another crop is the real reforestation policy that this country requires.

The most destructive enemy of Canada's forest is insect infestation and disease. The bud worm alone is now active in 45,000 square miles of forests with 15,000 square miles already destroyed. Insect and disease loss is estimated to have accounted for 700,000,000 cu. ft. of standing timber annually in Canada in the ten year period 1933-42. Anything that can be done to combat this menace on a material scale is of great value. And here we need active research, for our knowledge of insect and disease and methods of combatting the consequent damage, although growing, is still pitifully small.

Forest fires cut deep into our forests heritage. They account for about 11 per cent of the annual depletion of standing timber from all causes, or 444,000,000 cu. ft. of timber annually. But this is not the whole story of a forest fire. The humus of the forest soil is thin and fire destroys it, leaving land that can no longer produce trees or any other useful growth.

The work of fighting fires and preventing their origin is conservation and, in a manner also, indirect reforestation.

As regards modern methods of fire prevention and detection, it is wise to remember that a forest fire once thoroughly underway cannot be stopped by man, at least not by any methods which we have yet been able to devise. It may be delayed until the needed rain appears but it cannot be stopped. Today, prevention is the best method of combatting the fire menace.

On the side of prevention the industry has aided fire prevention campaigns and conducted extensive educational programmes within the ranks of its own employees. As a result, only two per cent of fires in the 1933-42 average were attributed to industrial operations.

In spite of our efforts, greater use of the forest by the public has increased the number of fires by 11 per cent in 21 years, while improved protective services have decreased the number of acres burned by 53 per cent during the same period.

Fifty per cent of fires started in the Canadian forests during the past ten years have been caused by smokers, camp fires and settlers' brush fires. With this kind of carelessness no wonder our forests are burnt.

Modern roadbuilding methods have also aided in preventing and combatting forest fires. The industry can build roads with a view to adequate fire protection of the forest and, at the same time, place them in such a position that they will serve economically in operations of moving men, supplies and pulpwood.

With the advent of the heavy diesel engine bulldozer, the cost of road construction has dropped to a more economic level and rough but effective roads are now being built by the industry through the forests which will pass heavily loaded trucks at average speeds up to fifteen miles per hour. These roads serve both for woods operations and protection.

Governmental bodies have aided prevention by establishing brush burning seasons and regulations regarding setting out fires and travelling in the woods.

On the side of fire detection, the industry works in close co-operation with government fire prevention services. The watch tower is still the standard method of fire detection. In this system a series of towers in telephonic communication with each other and with headquarters from which fire fighters can be despatched are located through the forests. Each tower is equipped with a plane-table and map of the area. The fire watcher reports a fire and gives the bearing on which he observes it. When two or more towers have reported, the origin of the fire can be located at the point of intersection of the bearings and fire fighting equipment sent out.

The use of the aeroplane as a means of detection is developing. Unfortunately, it cannot fly and see in all weather. In isolated places planes can be used for directing firefighters during the course of a large fire and also in dropping men and supplies into areas that cannot be reached immediately by road.

Any future plan for the protection of our forests should keep two objects clearly in view, first, the education of the people who use the forests for work or play, and second, the provision of adequate means of spotting and reaching incipient blazes.

The science of the growth and development of trees is relatively new, but for many years the industry has carefully estimated the amount which can be cut over each year without affecting the normal recovery of the forest. As areas now under observation reach maturity it will be possible for us to determine more closely the point at which it is most economical to cut the regrowth of the forest.

Assisting in the work of advancing our knowledge of the forests are about 400 technically trained foresters employed by government bodies and by the industry. In addition to administrative work, these men carry out surveys for estimating timber stands and making maps or determining growth and reproduction factors. They perform a very important work. There is need for more of them. Well trained foresters are essential for good management, economic operation and adequate protection—in other words for conservation for use.

Another field, which, because of its romantic aspect has led to many misconceptions, is the development of aerial photography and mapping. Canada has pioneered this development over the past twenty years and, today, 950,000 square miles of territory have been photographed within the Dominion, of which 116,400 square miles was forest area.

The chief aid of aerial photography to the forest industry is that it brings the forest into the office. As exact tree species and tree heights cannot be known from photographs, co-related ground work must be done. The results of this work can now be plotted accurately beforehand and the element of blind exploration eliminated. Mistakes in laying out roads and locating camps, which often cost a company dearly in the past, can also be avoided.

Some companies now photograph areas after they have been cut, in order to determine whether or not jobbers have complied with the terms of their contracts in cutting the area.

Before leaving the subject of the forests, we will deal briefly with the tenants of Canada's forest areas. Of Crown lands, pulp and paper companies occupy about 135,000 square miles under licence and saw-timber licences about 37,000 square miles.

Individuals and corporations owning forest lands in fee simple are largely located in the maritime provinces. They occupy 53,000 square miles, while farm wood lots occupy 49,000 square miles.

Total occupied forest lands cover 276,000 square miles out of the 430,000 square miles of productive forest that is considered accessible at the present time.

In addition, the Dominion and provincial governments hold in parks and reserves areas totalling 170,000 square miles.

Exports

The rapid expansion of the pulp and paper industry from the beginning of the century has carried it from an almost solely domestic manufacture with an annual output of $8,000,000 to an export industry with an output of $345,000,000.

In the five-year period immediately preceding the war, Great Britain imported about 2,000,000 tons of pulp a year from Europe and an almost negligible amount from Canada, while the United States took nearly a million tons of pulp from Europe and less than 600,000 tons a year from Canada.

In the pre-war years, the three Scandinavian countries had a combined newsprint capacity of about one million tons per annum and exported about 810,000 tons a year during the period 1937-39. Canada, with a mill capacity of over four million tons per year exported an average of 2,810,000 tons a year during that period.

Figures for world pulp production are not available for the war years but, in Fig. 2, comparison with the Canadian pulp production curve indicates that we produce about 20 per cent of the world supply of this commodity.

During the war years, the industry suffered from two factors, the diversion of large blocks of electrical power to war industry and the loss of manpower to the armed forces and to the production of munitions.

Emergency measures were taken by both the government and industry to secure all possible farm help for forest work. Coupled with other measures such as lengthening the cutting season and constructing additional dams and roads where necessary, the industry succeeded, over the period 1940-44, in exceeding peacetime production of pulpwood by 35 per cent.

Newsprint production also increased. In the five pre-war years, annual production averaged 3,003,000 tons, while in the five war years, average annual production was 3,229,000 tons. In North America, our mills have supplied all Canadian requirements and between 70 and 75 per cent of the total requirements of the United States. In addition, we have supplied the bulk of the newsprint requirements of forty free countries.

The industry has striven to maintain stability of prices during this war, despite increasing costs. The price of newsprint remained at the 1938 level of $50 per ton until March 1st, 1943, when costs had advanced to a point where some increase had to be made. The current price of $61 per ton only became effective on April 1st of this year. Compare this with the record of the last war during which Canada was not a large producer of newsprint. Prices for newsprint rose from approximately $39 per ton in 1913 to approximately $80 in 1919.

One fact stands out very clearly. The industry is one of our greatest sources of export income. Only gold surpasses it in the dollar value of exports and, on a basis of net value of exports, pulp and paper is Canada's greatest asset. It has in the past consistently exceeded wheat, nickel or any other Canadian product except gold. In 1943, this country produced about $346,000,000 of pulp, newsprint and other pulpwood products; of that amount 75 per cent or about $260,000,000 was paid to Canada in foreign exchange for exports.

Even in the depressed years of 1930 to 1935, and in spite of disrupted conditions, the newsprint section alone of the industry brought Canada $563,000,000 compared with $130,000,000 from nickel exports and $475,000,000 from gold.

Postwar Problems and Postwar Planning

The post war problems of the Canadian pulp and paper industry are integral parts of the post-war problems of Canada.

This nation is geared to an export economy. Last year our national income approximated 9 billion dollars. Our exports reached a new high of almost 3½ billion dollars or more than one-third of our national income.

We are a nation of only $11\frac{1}{2}$ million people but in the immediate pre-war period we occupied the position of fourth largest exporter. During this war we have expanded our factories and developed our industries to a point which leaves Canada with a tremendous potential capacity to produce goods.

Thus Canada's greatest post-war problems are to reconvert much of its industry from wartime production to peacetime production and to find economic world markets for her products.

World trade and Canada's part in it will shape our economic destiny and will determine our standard of living, our wages, our profits, and our use of our natural resources.

Restoration of world trade indeed rests in the hands of governments. Therefore it is most important to establish a proper collaboration between government and industry.

The pulp and paper industry, however, has no major reconversion problem to deal with in the post-war years. It has been engaged essentially in the manufacture of its own products. Furthermore its plants are, with the exception of a certain amount of deferred maintenance, in reasonably good physical condition.

The industry's position as a major contributor to Canada's export trade makes its maintenance and growth a matter of prime importance to the nation. It is an asset which should be developed in the post-war years by industry and government for the good of the Canadian people.

It is well known in the industry that there existed, prior to the war, a surplus of capacity for the production of pulp and paper in relation to the then world demand. In spite of this a recent survey by the United States Department of Commerce states: "In future years, increased wood pulp production in terms of millions of tons will be needed."

This divergence of opinion in respect of over capacity to produce and the necessity of millions of tons of additional wood pulp production presents a grave problem. Uneconomic expansion of facilities to produce pulp and paper would soon put the world industry and Canada in the same position as before the war. On the other hand failure to supply available markets would involve a failure to take advantage of our natural resources.

The problems of the post-war and long pull periods for this industry may be classified as:—

1. The problem of economic production on a world wide competitive basis;
2. The problem of world consumption and growth;
3. The problem of world markets and world distribution.

These must not be approached in any haphazard manner.

It is a difficult task to attempt to predict future market conditions for this or any other industry. But there are certain factors essential to the proper development of this industry in the post-war periods which should be mentioned.

The first of these is factual information. The collection and dissemination of such information is one of the major duties of a trade association. For this purpose the Canadian Pulp and Paper Association and its co-partner, the Newsprint Association of Canada, maintain important statistical departments, correlated to avoid duplication. The statistical data obtained by these associations, while specific to the Canadian pulp and paper industry, are world wide in their scope, and are made available to the management of the industry, to government authorities and, wherever useful or interesting, to the public at large.

The second factor is research. In the early days of this industry we used to talk of the "art of paper-making." Today, the manufacture of pulp and paper products is based upon applied science.

This industry was in fact the first industry in Canada to recognize the importance of a research organization which would act for a collective group of financially separate organizations. Under the auspices of the Canadian Pulp and Paper Association, in 1928, the Pulp and Paper Institute of Canada was built and equipped at a cost to the industry of over $350,000. This institute is remarkable in that its operation is now the joint undertaking of the industry, the Dominion Government and McGill University, both as to finance and operation. During the war, the majority of its work has been devoted to research directly connected with the Canadian war effort. Naturally this came first, and pulp and paper second, so that for a time our research in the field of pulp and paper has fallen behind.

Many companies in our industry maintain industrial research and development laboratories, and many more have included such departments in their post war plans, but here too the war has retarded or eliminated normal progress.

From research pure and applied, fundamental and industrial will flow much of the ability of this industry to retain and develop the place which it has established for itself in the world.

This industry, conscious of its responsibilities in the Canadian economic pattern will not be found wanting in its progressive support of research.

The third, and in some respects the most important factor is personnel. An industry is only as sound as its management and employees. During the war, the industry gave employees to the armed forces and to other industries engaged in the war effort. Their call to other duties has left gaps in our ranks which we eagerly wait to refill.

But the mere filling of vacancies is not enough. In an industry as large as this, there must be a constant flow of young and eager men into its ranks.

The industry will need men to manage and harvest the wood crop. It will need skilled workers to operate the plants, engineers for maintenance and improvements, scientists to advance the work of research and accountants and managers for its offices.

Perhaps for the young man returning from the war, "Civvy Street" may look dull and uninspiring. It does not appear to move with the tempo of battle, with the speed of an attack. But the adventure of piloting this industry through the dangerous waters of the future should fire the imagination. At moments it will offer all the excitement of soldiering but it will never offer that curse of a soldier's life, the long periods of boredom.

POSTWAR ENGINEERING OPPORTUNITIES IN ALASKA AND THE CANADIAN SUB-ARCTIC

RICHARD FINNIE

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Under the general heading "Alaska" most Americans invariably group the bulk of the North American Arctic and sub-Arctic regions. Erroneous though this is, it is not unreasonable, for Alaska's economic and geographic situation is closely related to that of her neighbours to the east, who share many of her problems. Nowadays, more than ever before, one cannot consider Alaska in broad terms without considering also Canada's Yukon and Northwest Territories.

Prior to World War II, Alaska, the Yukon and Northwest Territories, together embracing some two million square miles, were insular both physically and spiritually. From the United Statees or southern Canada they could be reached only by water or air, and some portions were completely cut off for weeks or months on end. These factors militated against development and settlement, for comparatively few people cared to go to the trouble and considerable expense of pushing beyond the natural barriers into the high north.

Today the isolation is gone. One can travel anywhere by aeroplane. And from any point in the United States one can drive an automobile right to the centre of Alaska; one can communicate by radio with almost any town or village in the Arctic, and can actually telephone to Fairbanks, Whitehorse, or Norman Wells.

Historical Background

Until World War II, the background of Alaska was known to the extent that it was dubbed Seward's Folly or Seward's Icebox after its purchase from Russia in 1867 for $7,200,000 until its annual salmon and gold returns topped that figure. It was known as the scene of the fabulous Klondike Gold Rush of 1897-98 (actually in the Yukon Territory); and as a goal for summer tourists who sailed northward from Seattle or Vancouver and thrilled to the beauties of the Inside Passage.*

Popular knowledge of the Northwest Territories was even more sketchy. Although many books of travel and exploration touching on one section or another of that million-square-mile hinterland had been published, not until 1942 was there a volume available reviewing its geography, history and resources as a whole.**

Exploration of the Northwest Territories began with Martin Frobisher's fruitless search for a northwest passage to the Orient in 1576. It was traversed for the first time in 1906, by Amundsen, who took three years. The first time it was traversed in one season, was in 1944, by a patrol vessel of the Royal Canadian Mounted Police. Exploration continued with the Hudson's Bay Company's search for fur, and with Catholic and Anglican missionaries' search for souls.

Not until 1920 did the Northwest Territories produce any commercial commodities other than fur and whalebone. In that year an oil well was brought in by the Imperial Oil Company at a spot on the right bank of the Mackenzie River 75 miles south of the Arctic Circle and 52 miles down stream from an old trading post called Fort Norman. But that was 1,200 miles from Edmonton, the nearest city, and the local market for oil in those days was negligible. Consequently, in 1925 the several wells that had been drilled since the discovery were capped and the camp was deserted.

Bush Flying: a Boon to Development

The growth of commercial aviation in the United States and Canada put aeroplanes into the Northwest Territories, the Yukon and Alaska, and bush flying went hand in hand with mineral exploration. The early bush planes were mostly Fokkers, Fairchilds and Bellancas, and they were mounted on skis in winter and pontoons in summer, with the lakes and rivers as their landing fields. Prospectors, trappers, traders and missionaries were quick to make use of them, and to many northerners flying had become commonplace while still regarded as a hazardous enterprise by outsiders.

Although two Junkers monoplanes ventured into the Northwest Territories as early as 1921 to carry petroleum men to the scene of the Fort Norman discovery, and Rear Admiral Richard Byrd flew over Ellesmere Island in 1925, no considerable flying was done in that district until 1928-29.

In Alaska, however, flying began in 1920, when the late General William Mitchell sent four Army DeHavilands from Mineola to Nome. Four years later the Post Office department sponsored a series of test flights by the late Carl Ben Eilson between Fairbanks and McGrath, a distance of 272 miles. By 1938 there were more than a hundred landing fields in Alaska. There were several in the Yukon, but none in the Northwest Territories for, although flying there had assumed great proportions, it was still being carried on by ski- and float-planes.

In the Arctic and sub-Arctic, bush flying was an immediate and tremendous boon to mineral exploration, for it enabled prospectors and geologists to cover vast areas in a short summer season, and aerial photographs simplified their investigations. Parties of prospectors searched for and found sizable deposits of copper, and in 1930 silver and pitchblende were struck on the southeastern shore of 12,000-square-mile Great Bear Lake, just south of the Arctic Circle. The following year a mine was opened there—the richest radium mine in the world, destined to break the Belgian Congo monopoly—and the oil wells on the Mackenzie River 300 miles away were soon uncapped to fuel its machinery and the boats supplying it.

In 1938 the Northwest Territories' first gold brick

* An excellent reference work is Merle Colby's *"A Guide to Alaska"* (Macmillan). A more recent popular treatment is Evelyn Stefansson's *"Here is Alaska"* (Scribner); she also presents profiles of Alaskan and Canadian Far Northern communities in *"Within the Circle"* (Scribner).

** Finnie's *"Canada Moves North"* (Macmillan).

was poured at Yellowknife, a town with a population of a thousand, which had sprung up on the North Arm of Great Slave Lake, 300 miles to the south of the radium mine. This augmented the market for the products of Norman Wells, where an 840-barrel-per-day straight run refinery was installed in 1939, replacing a primitive but ingenious steam still. Aviation fuel as well as low-test gasoline and Diesel oil were now produced there, but the market was still small enough to be satisfied with an annual output of 24,000 barrels.

Meanwhile an enterprising and imaginative bush flier named Grant McConachie had promoted an aerial express and passenger service between Edmonton, Alberta, and Whitehorse, Yukon, just under a thousand miles via Grande Prairie, Fort St. John, Fort Nelson and Watson Lake. Starting with ski- and float-equipped planes, he soon scratched out some landing fields and switched to wheel planes, which could carry bigger pay loads. He negotiated a Government mail contract and the Canadian Department of Transport undertook the construction of full-fledged airports to make the Edmonton-Whitehorse route permanent.

These two seemingly unrelated developments—the revitalized Norman Wells oil field and the inland air route to Whitehorse—set the stage for the Alaska Highway and its fueling system.

Defence Projects

After Pearl Harbor the United States and Canada became sickeningly aware of the Japanese threat in the Pacific, which included Alaskan waters. There would have to be an overland defense route to Alaska. The one the War Department chose was determined by the chain of airfields already in use between Edmonton and Whitehorse, and others between Whitehorse and Fairbanks, in the heart of Alaska. The Alaska Highway would tie in all of these fields, some of which were already connected by roads or trails.

Shortly after the Alaska Highway had been started, a plan was formulated to tap a local source of oil to help fuel it and its airfields as insurance against the cutting off of the sea lanes between California and Alaska, and to save tankers that were urgently needed elsewhere. The nearest available oil field was at Norman Wells, about 500 air miles northeast of Whitehorse, the strategic potentialities of which had been repeatedly referred to the War Department by Vilhjalmur Stefansson, the Arctic explorer and scholar.

United States Engineer troops pioneered the Alaska Highway, beginning in March, 1942, followed by scores of civilian construction companies who turned it into an all-weather road by October, 1943. In May, 1942, under the direction of the Corps of Engineers and with Engineer troops, Bechtel-Price-Callahan, a combination of large American construction companies, began the Canol Project which was to fuel the Alaska Highway and its airfields.

The Alaska Highway has been hailed as a wonderful engineering and construction achievement, and properly so, for it is one of the wonders of the modern world. Yet its construction was no more difficult and certainly less complex than the Canol Project. Whereas the former entailed the building of a 1500-mile road and 80-odd major bridges, the latter entailed: (1) the expanding of a sub-Arctic oil field to step up its production from 24,000 barrels a year to a million and a half barrels or more (2) the laying of a 600-mile pipeline across sketchily-charted, little-known mountainous terrain from Norman Wells to Whitehorse (3) the construction of a refinery at Whitehorse (4) the laying of a 110-mile pipeline between Whitehorse and tidewater at Skagway, (5) the laying of a pipeline from an intermediate point on the Skagway-Whitehorse line to Watson Lake, an airport 265 miles eastward, (6) the laying of a pipeline from Whitehorse 600 miles northwestward to Fairbanks.

To accomplish these tasks, the Army and Bechtel-Price-Callahan had to set up their own transportation system. They had to build and operate their own boats and barges on 1,100 miles of the Mackenzie waterway, as well as a dozen airfields in the Mackenzie District. They had to build and completely equip scores of big semi-permanent camps, various terminal facilities and ten tank farms, as well as pumping stations at 50-mile intervals along the main and supplementary pipelines. They had to build innumerable small bridges and culverts, and to pioneer more miles of access roads than did the builders of the Alaska Highway.

During the early stages of the Alaska Highway and Canol construction, Japs invaded the Aleutians, but before they could gain a foothold on the mainland or harass shipping in Alaskan waters they were driven out. It was via the airfields of the Alaska Highway that many of the defending planes flew, and it was gasoline pumped through the supplementary pipelines of Canol that helped to speed the planes on their way. It was California gasoline, however, for the supplementary lines were in operation a year before the Canol crude line from Norman Wells could be completed. To the Soviet Union by the same route flew thousands of Lend-Lease fighters and bombers to take part in the campaign against Germany in the east.

While the airports and flight strips in the Mackenzie district, the Yukon and Alaska were being constructed or enlarged, airports were appearing also in the eastern part of the North American North, in Hudson Bay, Baffin Island and Labrador, serving as patrol and transatlantic ferry bases.

Permanent Value of Military Installations

Short-sighted and forgetful people have condemned Canol and even the Alaska Highway as a waste of money and as unnecessary to the prosecution of the war. Such people have overlooked or minimized the grave situation that prompted the construction of these projects, and they have not realized that these projects have already made substantial contributions to military necessity. Indeed, until the Japs are vanquished and until peace reigns throughout the world forever, the Alaska Highway and its airfields and the Canol Project and its appurtenances, will remain of great strategic importance.

For World War II many a military installation has been created at high cost only to be abandoned as useless because the fighting didn't happen to pass just that way. Our northern installations—whether they contributed directly to the fighting or not—are notable exceptions. The Alaska Highway, the Canol Project, and all the airfields and roads spread across sub-Arctic Canada and Alaska during this war need not be written off. Irrespective of their present military value they have more than justified themselves in opening up hundreds of thousands of square miles of virgin country to post-war development.

These projects have also introduced scores of thousands of people, both soldiers and civilians, women as well as men, to a new and exciting land—a land that proved habitable and quite different from the bleak story-book picture of the high north; a land offering opportunities galore to ambitious, adaptable and imaginative pioneers. A lot of those wartime residents of the north will return in peacetime with their families and friends, either to visit or to settle, and many others will be attracted, too, hoping to carve out new careers for themselves.

Visions of the Future

And what can they do to make a living? Here are a few of the things to be done; here are some of the opportunities. They may be grouped under the main headings: (1) Transportation by land, water and air, (2) Tourist traffic, (3) Mining, (4) Fishing, (5) Fur farming, (6) Lumbering, (7) Agriculture and Stock Raising. The opportunities will be self-evident.

Already, some of the leading flying companies are vying for northern concessions. They know that the shortest routes between northern population centres in the Western Hemisphere and those in the Eastern Hemisphere are across the Polar Mediterranean. There is bound to be a great deal of trans-Polar flying after the war. Most of the existing bases in the North will be used and others will be built for both long-distance and local traffic.

The Alaska Highway must be maintained, and sooner or later its gravel surface will be topped with oil from the tar sands of Fort McMurray (the greatest known oil reserve in the world, 300 miles north of Edmonton). Eventually the Highway will be extended to Tanana and Nome, and a tunnel may be bored 50 odd miles under the Bering Sea to connect North America with Asia.

Soon there may be a railroad pushing northward from Prince George, British Columbia, via the Rocky Mountain trench to the Yukon and Alaska. The route was surveyed prior to the building of the Alaska Highway, and it has been declared perfectly feasible, with no grade as much as one per cent.

The winter road which now runs down the valley of the Mackenzie River as far as Norman Wells (it was pioneered in 1943 to carry freight for the Canol Project) will one day be turned into an all-weather artery and continued to the Arctic Coast. It already ties in with the railhead and a provincial highway near the town of Peace River, so that when it is completed it will provide year-round overland access to and from the rich Mackenzie Basin and the outside world.

On the Canol Project and the Alaska Highway much knowledge was gained and applied in road and airfield building and other construction where the sub-soil was permanently frozen to varying depths down to a hundred feet, and where springs bubbled out in the dead of winter to create ice barriers. Much was learned about the cold-weather operation of machinery, but there remains a great deal of studying and experimenting to be done by engineers in these fields. Incidentally, a fortune awaits the man who can exterminate mosquitoes and black fles in settled areas in the north where, although they carry no disease, they cause almost unending annoyance in summer.

Right after the war, the moment gasoline and tires are plentiful and there are no longer any travel restrictions, there will be tourists in the eastern Arctic and more tourists in the Mackenzie River Valley, the Yukon Territory and Alaska. Many of them will be driving over the Alaska Highway. Wherever they go they will require goods and services.

Resources Plentiful

In northern fishing, fur farming, agriculture, and stock raising there are post-war opportunities. The Alaskan salmon fishing and canning industry is of course world-famous and enormously lucrative. The trapping of fur-bearing animals is carried on mostly by the Indians and Eskimos, for whom it is the chief means of making money, and in the Canadian far north (not in Alaska) whites are discouraged from competing with them. But fur-farming can be carried on almost everywhere and it offers interesting possibilities. Agriculture and stock raising present a challenge. Both farming and cattle raising have been carried on in Alaska and the Canadian far north for many years, but only in a limited and usually unscientific way. Great subjects for investigation are the finding and applying of better methods of growing hardy grains and vegetables in favoured areas of the Arctic and sub-Arctic (the Soviets are farther advanced than we are in this direction), and to make fuller use of such logical animals as reindeer and musk-oxen in the North, as well as domestic farm animals—all to create and distribute adequate local food supplies.

Important among northern resources are the forests which cover most of the Mackenzie Basin, the Yukon and Alaska. Spruce, jackpine, poplar and birch are widespread, and everywhere except on the Arctic prairies wood may be found for local fuel and building purposes. Along the southern coast of Alaska are four million acres of spruce and hemlock used for everything from shingles to piles and capable of supplying a million tons of newsprint a year in perpetuity.

There is another northern resource that can be harnessed as need arises: water power. So far it has scarcely been touched, although promising sites have been located on a number of the large rivers. At Yellowknife, on Great Slave Lake, hydro-electric power was developed a few years ago on the Yellowknife River, and it has since served the town and the neighbouring mines.

It is in mining that the north offers the most enticing prospects for the immediate future, for at the outset the development of most of the other resources of the country must depend on mineral development. Prospecting and mining will bring in new settlers and other supporting activities will enable them to stay.

The value of the annual output of pitchblende, silver and gold now far exceeds that of fur in the Canadian sector of the high north, yet these ores have so far been exploited in only a few small areas and, excluding petroleum, other minerals have hardly been scratched. Coal is widely distributed, but that found has been mostly of low grade and hasn't been worked to any extent. (Alaska has good coal, producing a hundred thousand tons or more a year.) Copper, lead, zinc and other industrial metals, including tungsten, platinum and tantalum, are in the Northwest Territories but only recently have they been given serious attention. The Yukon, of course, has ranked with Alaska in copper as well as gold production in past years, and dredging and hydraulic methods long ago replaced the gold pan of the Klondike. Alaska has done well in mineral production, exporting not only gold, silver and copper, but some platinum, lead, tin and other mineral commodities, totalling over $900,000,000. Still, less than half of Alaska has been surveyed topographically or geologically, and as much or more work in this direction remains to be done in the Canadian North.

Much of the great Mackenzie Basin in favourable for petroleum discoveries, yet intensive drilling has been done only within the purlieus of Norman Wells. (Most of this drilling was part of the Canol Project, which proved the existence of a major field.)

Oil production in Alaska has so far been small. One or two fields were tapped a few years ago, notably in the Katalla district on the Gulf of Alaska. But there is a potentially important source south of Point Barrow on the Arctic Coast. Seepages were observed there as early as 1886 by the late Charles Brower, and in 1923 the U.S. Navy set aside 3,000 square miles north of the Endicott Range as a petroleum reserve. Thereafter it was visited from time to time by geologists, who were uniformly impressed. But no thorough investigation was undertaken until very recently, when a party of Seabees began probing around Cape Simpson, 50 miles from the settlement of Barrow. The day may not be far distant when Barrow crude oil will be shipped around the Arctic Coast through Bering Strait to ports in southern Alaska and elsewhere, or a pipeline may be laid from the Barrow vicinity to Fairbanks, where a refinery could be erected.

All in all, Alaska, the Yukon and the Northwest Territories have tremendous possibilities. Their combined area of 2,000,000 square miles of forests, plains, mountains, lakes and rivers certainly has room enough for a considerably larger population than the present permanent one of around 75,000 whites, Indians and Eskimos.

The other day I came across this definition of engineering: "The art of directing and controlling men and the forces and materials of nature for the benefit of the human race." Alaska and the Canadian far north surely offer unlimited scope for that sort of engineering.

UNION SECURITY CLAUSES IN CANADIAN COLLECTIVE LABOUR AGREEMENTS

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This paper was prepared at the request of the Institute's Committee on Industrial Relations, as part of the plan of placing before the membership of the Institute matters that are related to the managerial and directional activities of the engineer.

The demand on the part of labour unions for the inclusion of "union security" clauses in collective agreements has recently given rise to a relatively large number of labour disputes in Canadian industry. Such disputes, however, have not been given much publicity in the press. As a result, most Canadians are not even aware that this particular matter gives rise to peculiarly stubborn disputes between management and labour unions.

It is not the purpose of this article to present the arguments submitted by the disputants in support of the stand which they adopt. Nor is it the intention to propose a ready-made solution of the problems at issue. If there be such a solution, the author has failed to discover it. The intention here is simply to examine the social and economic basis of the demand for "union security", and to indicate the extent to which labour unions have succeeded in persuading employers to include union security clauses in recent collective labour agreements.

At the outset perhaps it would be well to define certain terms.

The Closed Shop

When an employer agrees to hire only persons who are members of a particular union and requires them to maintain their union membership as a condition of employment, he has established a closed shop. Here is a typical clause taken from a collective labour agreement:

> "All employees hired by the employer must be members of the Union in good standing. Upon notification by the Union, the employer will discharge any employee who loses his good standing with the Union."

The Union Shop

In this case all persons who are employed must, within a specified time after hiring, become union members, and must thereafter remain members as a condition of employment. The employer has complete freedom when hiring new employees. For example:

> "The parties of the first part will not employ any employee in the groups represented by the parties of the second part (union) who is not or who does not, within one month after his employment, become and remain a member in good standing of the union, and all present employees of the groups to which this agreement applies who are not members of the union, shall become and remain members in good standing within thirty days of the date of this agreement."

Preferential Union Shop

Here the employer agrees to give preference in hiring to members of the union in question. He may also give preference to members of the union in lay-offs or re-hiring, or in some other aspect of employment. While there is no compulsion on either present employees or applicants for employment to join the union, and no undertaking on the part of the employer to require persons who become union members to maintain their membership as a condition of employment, the intention is to place such a handicap on non-union employees as to make membership in the union highly desirable. For example:

> "When reductions in working force are being made, persons who are not members of the union shall be laid off before the lay-off of any member of the union. In hiring employees, members of the

union shall be given preference, and persons not members of the union shall be hired only when competent members of the union are not available.

Any employee not a member in good standing with the union, shall hold no seniority rights with the company."

Maintenance of Union Membership

Here all employees who are members of the union on a specified date, as well as those who subsequently become members, must maintain their membership as a condition of employment. For example:

"All employees who are now members of the union or who may later become members shall remain members in good standing as a condition of employment."

In practice, arrangements are often made between employers and unions which do not fit exactly into any of the categories outlined above. The clause dealing with the closed shop may provide that entrance to the union is restricted to persons who meet certain trade requirements or who are in some other way acceptable to the union; or the union may undertake to admit anyone to membership provided he subscribes to its constitution and by-laws. Some clauses specify definitely the conditions under which persons will be admitted to union membership and the initiation fee that will be charged. Closed shop and preferential shop provisions may specify that all hiring be done through the union. Again, the union shop clause may provide that union members will be given preference in hiring. Finally, a maintenance of membership clause may provide that a job becomes a " union job " once the incumbent of the position has joined the union. If the incumbent quits or is discharged, the employee who replaces him must be a union member.

The Social and Economic Basis of the Demand for Union Security

The demand on the part of labour unions for clauses in collective labour agreements such as those enumerated above is peculiar to this continent. Union security provisions are not common in Europe, either in those European countries where labour unions are securely established or in those where the position of unions is insecure. It is true that during the militant stage of trade unionism in Great Britain and in Sweden, the unions sought to secure their position through devices analagous to the closed shop. Latterly, however, British trade unionism has found no serious difficulty in recruiting and maintaining its membership. Through the support of the vast majority of the working class, it has acquired what amounts to a " voluntary " closed shop. This development has effectively settled the question. In Sweden the closed shop was removed from the field of controversy in much the same fashion. But in the United States and Canada the issue seems to grow with trade unionism rather than decline with its growth according to the European pattern.

This continued and growing importance of the closed shop in the United States and Canada has been variously explained. Some have argued that the unusually active and effective opposition of employers to trade unionism has called for strong defensive measures on the part of the unions. According to this view, the closed shop has been adopted as the ultimate in union security against employer-sponsored attacks. Others claim that this argument has lost much of its force in view of the fact that increasingly strong union demands for the closed shop persist even though recent legislation has softened employers' opposition both to collective bargaining and to union activities on the part of their employees. However, it is doubtful if employer opposition, long standing and deeply rooted, can be obliterated over night by any act of any legislature in a democratic country. The closed shop or the union shop, as far as a union organizer is concerned, remains desirable as an effective weapon against a hostile employer.

It has been held by some that the closed shop has been advocated by organized labour in the United States and Canada to protect the wages earner from the competition of the immigrant and the non-industrial worker, both attracted to industry by the relatively high wages. It is probably true that the industrial worker has found the competition of these groups keen and annoying. Industry on this continent can assimilate unskilled labour. Therefore the possession of skill has afforded the industrial worker but slight protection against the unskilled immigrant and agricultural worker. No doubt the closed shop, well-established, would at least slow down the rate at which these " outsiders " are absorbed into industry and would therefore protect the field in which the trade union man might find employment. However, with mass immigration over and with the pool of non-industrial labour much reduced in size, the trade unionist's position is not as seriously threatened as in the past by the outsider.

Others have maintained that the closed shop is essential to the establishment and maintenance of strong union membership which, in turn, is essential to a successful trade union movement. The latter part of this argument can be readily accepted. Strong union membership is essential to a successful trâde union movement. However, the assertion that strong union membership cannot be secured and maintained in the United States and Canada without the closed shop calls for some explanation.

It is apparently true that trade unions here have found greater difficulty than European trade unions in securing and maintaining their membership. The typical American or Canadian worker is not as willing as the typical British worker to join a union. Moreover, having joined, he is much more likely to drop out than the British worker. Here again various explanations have been advanced. It has been pointed out that American and Canadian workers are largely unskilled or semi-skilled. They have few craft interests to bind them into groups. Moreover there are barriers of nationality, language and colour which add to the difficulties. The British workers, on the other hand, form a homogeneous group. They are largely semi-skilled or skilled and naturally gather in groups on the basis of common skills. Then, the American and Canadian worker is said to be more individualistic and self reliant in his outlook than the British worker. He is not inclined to give up this individualism readily to act as a member of a group. Others maintain that many American and Canadian workers are opposed to trade unions as such—an unreasoned opposition that leads them to refuse to join.

Such arguments as these, according to some students, fail to touch the heart of the matter. The trade union movement, they contend, has failed to secure the whole-hearted support of American and Canadian labour because of two typically American conditions. In the first place, society in the United States and in Canada, though not exactly classless, has no clear-cut or impassable class boundaries. The wage earner, therefore, is not group conscious or class conscious. He may be, at the moment, a member of what might be termed "the working class." But the more enterprising workman looks forward to the time when he will move on to something better than his present job. He is, therefore, not eager to identify himself for any long period with an organization which has a working-class basis and working-class aims and objectives. For that reason, he will not join a union or, if he joins, he will not give it his continuous support.

The second and even more fundamental reason advanced for the worker's indifference to trade unionism is this:

In the United States and in Canada, labour, on the whole, is more productive than labour in any other part of the world. The average worker can produce more in a day than any other worker. As a consequence, he can demand and secure a larger return per day than any other worker. Various theories have been advanced to account for this happy situation. Some would have us believe that the climate is conducive to the maximum human enterprise and activity. Some point to the abundance of natural resources or the highly-developed mass production methods as the explanation. Others have discovered the secret in the qualities inherent in the people who settled this continent. We are not greatly concerned here as to which of these theories is the correct one. The fact remains that the United States and Canadian worker is unusually productive, that he enjoys a much larger income and that, as a consequence, he enjoys a much larger measure of economic freedom and security than workers in other great industrial nations.

This description of the United States and Canadian worker's economic situation is in very general terms. It cannot be denied that there are many people working here for wages that would be termed low in any industrial country. But the significant fact for the organized labour movement is that there is a substantial group working for wages that are high. Moreover, there is another group of individuals confident of their ability to work into this highly-paid category. These two groups of individuals are not prepared to participate in the labour movement, except perhaps as a temporary expedient. They can through their own efforts, so they believe, secure the important things that organized labour promises, high wages and a measure of economic security. Why should they participate in a struggle to secure what they already possess?

Some students, then, see organized labour in its attempt to construct a solid labour front faced in every plant with the problem of the recalcitrant minority — the ten or twenty or perhaps thirty per cent of the working force that refuses to "join up." The labour union has no basis on which to appeal to these men. They are not interested either in the labour movement as such, or in "the class struggle", or in raising wages in general. Yet their support is considered essential to the success of labour's programme. In an attempt to solve this apparently insoluble problem, organized labour favours the closed shop as an effective device to secure the full support of the working force. Under its terms the minority is either forced into membership or forced out of employment, preferably the former.

This theory offers an explanation of the continuous growth and increasing importance of the closed shop as trade unionism has increased in strength in the United States and Canada. The larger the movement grows, the more numerous and powerful its members and adherents become, the stronger are the cries against the minority that refuses to participate. Yet the existence of that minority is a result of conditions that are characteristic of the North American continent — the high productivity of labour together with the opportunities for advancement open to enterprising individuals in a society which has no sharp class or group boundaries. Here there seems to be the setting for a long and difficult struggle. A powerful group seeks to establish an institution, which comes in direct conflict with institutions already firmly rooted in society.

It is impossible to say which of these theories actually does account for the appearance and growth of the closed shop and union shop movement in the United States. It is likely that some combination of all the causes presented, rather than any one of them, lies at the bottom of the movement.*

Security Clauses in Canadian Union Agreements

Of 236 agreements which were in effect at the end of January, 1944, 122 or 52 per cent contained some form of "union security" clause. The closed shop or the union shop occurred in 73, or 31 per cent, of the agreements in the sample. The closed shop clause, which is the strongest union security clause, was found chiefly in agreements in industries employing highly skilled workers; the union shop is strong in the pulp and paper industry; maintenance of membership and check-off were found chiefly in mass production industries.

Although this survey covered a large number of existing Canadian agreements, it has by no means covered them all. Moreover, many Canadian companies have no collective agreements with their employees. It is wrong, therefore, to conclude from the figures given below that 52 per cent of Canadian employees are working under union security clauses. All that can be concluded is that about one-half of the agreements examined contained a union security clause in some form or other.

Type of Recognition Clause	No. of Agreements in Which Clause Occurs	Per Cent
Open shop, no check-off	114	48
Open shop with check-off clause	17	7
Maintenance of membership clause; no check-off clause	16	7
Maintenance of membership and check-off clause	8	3
Union Shop Clause; no check-off clause	35	15
Union Shop Clause with check-off clause	8	3
Closed shop; no check-off clause	30	13
Closed shop with check-off	0	0
Preferential Union Shop; no check-off clause	8	3
Total	236	100

*For a complete discussion of this whole subject, see Bulletin No. 9, *The Closed Shop*, Department of Industrial Relations, Queen's University, Kingston, Ont.

From Month to Month

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

"COMMITTEE OF FOURTEEN" IS NO MORE

The report of Council's policy on co-operation with sister societies was presented in the June *Journal*. Since then there have been some developments which should be reported to the membership.

On June 12th, the Committee of Fourteen met at Ottawa for what turned out to be the last time. On a motion duly presented and carried it was decided that the responsibility of the Committee of Fourteen respecting collective bargaining be transferred to the newly created Canadian Council of Professional Engineers and Scientists.

The representative of the Institute opposed this action believing that the consideration of collective bargaining should be left with the group that was set up for that purpose, and which represented not only the fourteen societies from which it derived its title but a total of twenty organizations.

Earlier in the meeting the representative of the Institute presented a motion that the Committee of Three be enlarged to include representation from all provincial collective bargaining organizations and instructed to continue its work, reporting back to the Committee of Fourteen as required. The motion was supported by only one other organization and was defeated. Four others did not vote.

The action at Ottawa which dissolves the Committee of Fourteen, and hence the Committee of Three, which represented it at the public hearing before the Wartime Labour Relations Board and which carried out negotiations and other arrangements at Ottawa resulting in a favourable ruling by the Minister of Labour, appears to be a retrograde step.

The Institute has taken a leading part in all co-operative thinking and action on collective bargaining. It has paid by far the largest share of the joint cost of these efforts both in money and in time. It was the organization that first of all called the other organizations together to consider the suddenly promulgated collective bargaining legislation. The first two meetings of the nucleus of the group were called by the Institute and held at Institute headquarters.

The officers of the Institute regret that a difference of opinion concerning the formation of a new super council should force a separation in the joint effort that was being made successfully by the Committee of Fourteen on behalf of the profession.

The full text of the ruling issued by the Minister of Labour following the public hearing before the Wartime Labour Relations Board may be found in the March issue of the *Journal*. This ruling permits engineers to bargain under P.C. 1003 on their own behalf if they so wish. They cannot be outvoted by labour. A member of the Institute reports a recent case in which the engineers and other employees voted as a group for certification, but the Wartime Labour Relations Board arranged for a retake of the vote, with the engineers voting as a separate unit. In the opinion of the committee this establishes the rights for which the engineers have been asking.

The Institute Committee on Employment Conditions will continue to maintain close touch with the situation and will take such action as may be necessary in the best interest of its membership and the profession.

THE PRESIDENT VISITS ONTARIO AND QUEBEC

The second stage of the presidential tour of the branches was partially completed early in June. The president, accompanied by Mrs. Fetherstonhaugh, called on the branches at London, Windsor, Niagara Falls, and Hamilton in Ontario, Shawinigan Falls, Quebec and Arvida in Quebec. In addition, a regional meeting of Council was held in Hamilton. In Ontario the presidential party included the general secretary and Major MacCallum, the Institute's rehabilitation officer. In the province of Quebec, the president was accompanied by the assistant general secretary. Councillor P. E. Poitras of Montreal, who is president of the Corporation of Professional Engineers of Quebec, participated in the meetings at Shawinigan Falls and Quebec. The general secretary also accompanied the party at Quebec.

The first visit was at London on June 5th where, under the chairmanship of H. G. Stead, a delightful dinner meeting which the ladies also attended, was held at the Hunt Club.

In the afternoon, the party visited the University of Western Ontario and, under the guidance of Prof. G. Woonton, inspected several buildings including science, art and music, the observatory and the library. They also called on the president of the University, Dr. W. S. Fox.

From London, the party, accompanied by Councillor J. A. Vance, travelled to Windsor, where, on the 6th, under the chairmanship of A. H. MacQuarrie, an unusually large company, including the ladies, dined with the president. A pleasant feature of this visit was the presence of good friends from across the river at Detroit, all members of The American Society of Mechanical Engineers. The group included James Parker, president of the Detroit Edison Co., and a past-president of the A.S.M.E.; A. C. Pasini, chairman of the Detroit Section of the A.S.M.E.; R. Hanson, chairman of the programme committee; and R. K. Weldy, secretary-treasurer of the Section.

At luncheon, the party were guests of the Canadian Bridge Company in the staff dining room at Walkerville. This luncheon event has become a regular part of the president's programme, and adds a great deal to the pleasure of the visit to the Border Cities Branch.

After luncheon, an inspection tour was made of the nearly completed grain elevator of the Walker distillery. A. St. Clair Ryley was guide and the party included also the officers of the Detroit Section of the A.S.M.E.

On Thursday the 7th, the party arrived at Niagara Falls in time for lunch at the Refectory with members of the branch executive and their wives, after which there was a drive to Queenston along one of Canada's most beautiful highways.

The dinner meeting was held at the Refectory and opened under the chairmanship of W. D. Bracken, but

The head table at the Shawinigan Falls meeting. ***From left to right:*** **Branch Secretary A. Trudel, Assistant General Secretary L. Trudel, Councillor J. F. Wickenden of Three Rivers, Councillor P. E. Poitras of Montreal, President Fetherstonhaugh, Retiring Chairman R. Dorion, Incoming Chairman H. K. Wyman, Past Vice-President H. O. Keay, A. S. Holder.**

was concluded under the chairmanship of Jasper Ings who took over when the results of the annual elections were announced. This was probably the largest turnout that has greeted a president in this area, there being 75 members present.

On Friday, the Hamilton Branch met with the president for dinner at the Scottish Rite Club, with Norman Eager, chairman of the branch, presiding. After the three members of the president's party had spoken, there was an interesting and helpful discussion period.

On Saturday, a regional meeting of Council was held in the committee room of the Hamilton Golf and Country Club at Ancaster. This was one of the best attended meetings ever held away from Headquarters. There were thirty-five people in attendance of whom twelve were councillors, representing eight different branches, including Halifax and Montreal.

In Quebec Province

After a short respite in Montreal over the week-end, the president and his party left on Tuesday morning, June 12th, for Trois-Rivières where they were met at the station by the incoming chairman of the St. Maurice Valley Branch, H. K. Wyman and Mrs. Wyman. After a delightful reception at the house of J. H. Frégeau, a past-councillor of the Institute and past chairman of the Branch, the party were the guests of Mr. and Mrs. Frégeau for lunch, in company with Past Vice-President H. O. Keay.

In the afternoon, the party motored to Shawinigan Falls where the president immediately proceeded to inspect the hydro-electric power plants. At 5 o'clock, a civic reception was given the visitors at the city hall, when members of the Branch executive and their wives were present. In the absence of the mayor, City Manager Robert Dorion, retiring chairman of the Branch, very ably performed as official host and collected the visitors' signatures for the golden book.

The dinner meeting was held at the Cascade Inn and was the annual business meeting of the Branch. After the report from the secretary-treasurer and from the scrutineers, the meeting, which had been carried on up to this point under the chairmanship of Robert Dorion, was taken over by the new chairman, H. K. Wyman. The president spoke and was thanked by Councillor J. F. Wickenden. Councillor Poitras and the assistant general secretary also addressed the meeting.

The next morning the party were escorted by Branch Secretary A. Trudel to Trois-Rivières, where they entrained for Quebec.

At Quebec for dinner the branch joined with the Canadian Electrical Association which was holding its annual business meeting there. The president was the speaker and the meeting was carried out under the joint chairmanship of J. O. Martineau, chairman of the branch, and J. B. Hayes, president of the C.E.A.

Mr. Hayes, in introducing Dr. Fetherstonhaugh, gave a delightful dissertation in French which was replied to in part in the same language by the president. Other head table guests included Councillor Paul Poitras, president of the Corporation of Professional Engineers of Quebec, E. V. Caton of Winnipeg, vice-president of the C.E.A., H. E. Pawson, P. E. Gagnon, E. D. Gray-Donald, B. C. Fairchild, and the general secretary.

Dr. N. A. M. MacKenzie, president of the University of British Columbia, and Dean J. N. Finlayson of the same university, were very welcome guests at the reception which preceeded the dinner.

Dr. Fetherstonhaugh stayed in Quebec for the balance of the week to attend the Canadian Universities Conference. Wives of members of the executive took advantage of the additional time that was available to show Mrs. Fetherstonhaugh something of the country surrounding the city, including the Island of Orléans.

On Sunday morning, June 17th, the president and Mrs. Fetherstonhaugh, accompanied by Dean D. S. Ellis of Queen's University and the assistant general secretary, embarked upon the *SS. St. Lawrence* for Bagotville where they were met the following mornby Saguenay Branch Chairman K. A. Booth and driven to Arvida. In the forenoon, the president inspected the aluminum works and, in the afternoon, members of the branch with their wives joined the presidential party in a visit to the Shipshaw hydroelectric power plant, while another group inspected the Price Bros' paper mill at Kenogami.

At noon, the president and Mrs. Fetherstonhaugh had been entertained at lunch by the members of the Branch executive and their wives.

A well attended dinner meeting was held at the Saguenay Inn that evening under the chairmanship of K. A. Booth. Besides the president, the speakers were Dean D. S. Ellis, Past Vice-President McNeely DuBose and the assistant general secretary.

After the meeting, the party returned to the boat at Bagotville and arrived in Montreal on Wednesday morning with pleasant memories of a fruitful voyage.

AN URGENT REQUEST

Would members who do not file the *Journal* kindly return their June 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 four articles on Air Transportation appearing in that number are being reprinted as Aeronautical Reprint No. 12 of the *Journal*, so that members who wish to keep these papers will be supplied with copy of the reprint in return for their June copy of the *Journal* if they so desire.

IS THERE SOME HOPE FOR THE ENGINEER IN CIVIL SERVICE?

Believing that the most serious offender in the matter of poor wages for engineers, and therefore the one to whom most attention should be paid, is the government, the Council of the Institute, through its special committee, has been in frequent communication with the various parties responsible for the Federal wage scale, such as the Prime Minister, the Minister of Finance, the Treasury Board, and the Civil Service Commission.

Once again there are signs at Ottawa that consideration is being given to the subject. A new schedule recommended by the departments and the Civil Service Commission is before the Treasury Board. One must not be unduly optimistic. There have been similar signs in the past, out of which nothing has come. The Treasury Board has resisted every recommendation that has come to it from sources that are competent to judge. Its own sub-committee, set up in 1943 under the chairmanship of H. J. Coon, of the Bank of Nova Scotia, to study the whole civil service salary situation, made specific recommendations for increases which the Board seemingly disregarded. The subcommittee's report was never made public. Apparently it was too far out of line with the actions of the Board for the public to be permitted to know its contents.

No matter what is done now, it is likely the damage already wrought will not be repaired for many years. The Government has built for itself a heritage that likely will keep its engineering attainments at a low level for a generation. Its inability to secure engineers now for post-war work, and the failure of its post-war construction programme, which, under these circumstances seems inevitable, is the natural result of its past policy.

The *Journal* herewith presents an exchange of correspondence between high officers of the Institute and of the Government. The Institute is still trying to help the profession but it has been a discouraging experience, in the field of Federal administration. Let us hope that the Prime Minister's statement "this matter is receiving the active consideration of the appropriate authorities" results in the adoption of a living wage for an unfortunate group of professional workers.

What has been said in relation to the engineers is equally applicable to the other professional workers in the employ of the Government. They are all in the same boat—unfortunately!

* * *

Recently, the president of the Institute and the immediate past-president have written to the Prime Minister and the Minister of Finance relative to the possibility of increasing the remuneration of the engineers in the civil service. The replies to the letters give some slight gleam of promise. It is to be hoped that this gleam may develop into a strong ray of pure light that may well light the lives of hundreds of engineers whose lot has not been very pleasant in the past.

Montreal, May 31st, 1945.

Dear Mister Prime Minister:

Last year, in my capacity of president of The Engineering Institute of Canada, I wrote to you asking for your support for the bettering of the lot of the engineers in the Civil Service. For your convenience, I am enclosing a copy of that letter.

The remuneration received by the Civil Service engineers is woefully low in comparison to that of the engineers employed in industry. Since writing, the matter has been brought to the attention of the Treasury Board and, I believe, with the recommendation for increases.

May I ask you, dear Mr. King, to kindly consider this matter again, and see if it would be possible for the Government to treat the very loyal employees that are its engineers with a little more justice.

I am writing to you at the request of Dean E. P. Fetherstonhaugh, of Manitoba University, the present President of The Engineering Institute of Canada.

Respectfully submitted,

DE GASPÉ BEAUBIEN

* * *

The Right Honourable W. L. Mackenzie King,
Prime Minister of Canada,
Ottawa, Ont.

Ottawa, 4th June, 1945.

deGaspé Beaubien, Esq., C.B.E.,
Past-President, The Engineering Institute of Canada,

Dear Mr. Beaubien:

I have your letter of the 31st of May, referring to previous correspondence relating to the situation of professional engineers in the Civil Service.

In reply, I should like to assure you that this matter is receiving the active consideration of the appropriate authorities.

Yours sincerely,

(Signed) W. L. Mackenzie King.

* * *

Montreal, June 7th, 1945.

Hon. J. L. Ilsley,
Minister of Finance, Ottawa, Ont.

Dear Mr. Ilsley:

The Council of The Engineering Institute of Canada desires to bring again to the Minister of Finance the urgent need of upward revision of the salaries paid to engineers in the Government Service.

On March 5th, 1943, a committee of the Institute appeared before the Coon sub-committee of the Treasury Board and presented a brief on this subject which emphasized the inconsistency of the present policy, indicating clearly the differences in wages actually paid by the Government for engineers' services as between its own departments, Crown companies and general contractors.

The same committee had the privilege of presenting a copy of this brief to you on September 17th 1943, at which time the whole matter was again, from our point of view, clearly outlined and you had explained the application of the Salaries Order to the Government Service which prevented action being taken at that time. Since that time, however, there has been some revision of the restrictions to permit adjustments where "gross inequalities and gross injustices exist".

The Council is of the opinion that the salaries paid to engineers in the Government Service in practically every instance are cases of gross inequality and gross injustice.

Generous wage increases appear to be accorded from time to time by War Labour Boards concerned and undoubtedly the revision of the Salaries Order will result in general generous salary increases being accorded to industry.

The Government should be recognized as a good employer, not only among the lower paid groups but also among those in the professional classes. The records of the Wartime Bureau of Technical Personnel definitely indicate an increasing demand for engineers for the present and post-war periods at rates of pay far in excess of those now being paid by the Government to its own employees or being offered by the Government for additional engineers. There is a definite shortage of engineers at present and this shortage will increase, and there is an increasing demand from the United States for well qualified Canadian engineers at rates of pay considerably in excess of those being offered here.

The Council is concerned about the continuing loss of engineers to the Government Service and the quality of the engineers who are willing to accept employment in the Government Service at the present low rates. The Council believes that it is fully appreciative of the responsibilities and difficulties to be encountered in the post-war and reconstruction period and undoubtedly it is absolutely essential that the Government have in its service a large group of highly trained and well qualified engineers to advise on and carry out planning and work in this most important period. In the opinion of the Council this will not be possible unless some early action is taken on the long overdue salary revision.

In October 1944, the president, Mr. de Gaspé Beaubien, wrote to the Honourable the Prime Minister, concerning this matter which was important at that time, and Mr. King assured him that our representations would be brought to the attention of his colleagues. That situation is now much more acute.

I trust you will find it possible as a result of your recent announcement to allow reclassifications throughout the Government Service to support recommendations received from various Government departments employing engineers to adjust the salaries for engineers in order that the best qualified available may be obtained for the Government Service and also that it may be possible to retain some of those now in the Service.

May we count on your support?

Yours sincerely,

(Signed) E. P. Fetherstonhaugh,
President.

* * *

Treasury Board, Canada,
Ottawa, June 18th, 1945.

E. P. Fetherstonhaugh, Esq.,
President, The Engineering Institute of Canada,

Dear Mr. Fetherstonhaugh:

Mr. Ilsley has asked me to reply to your letter of June 7th concerning salary revision for engineers in the Government Service.

The general question of salary revision for professional and scientific classes is now under consideration by the Treasury Board. I shall be glad indeed to see that the views expressed in your letter are given careful attention.

Yours very truly,

(Signed) W. C. Ronson,
Acting Secretary.

NECESSARY READING FOR PROFESSIONAL DEVELOPMENT

Although the Engineers' Council for Professional Development has been in existence for over twelve years, and the Institute has been a member since 1940, not every member appreciates the excellent work that has been done. As E.C.P.D. is not an administrative body, most of its work is reported only to the governing groups of the eight member organizations. Through the *Journal*, the Institute tries to keep the members informed, basing its announcements on committee reports.

Recently one of the committees of the Council has completed a piece of work that can be shown in its entirety to the membership—a reading list for junior engineers. This important pamphlet has been purchased in quantity by the Institute for distribution to every member of the graduating class of engineers in Canada, but believing that its interest and usefulness goes beyond this group, the *Journal* is printing it in full in this issue.

Certain titles have been added at the end of the original list by the Engineering Institute, in order to widen its interest to Canadians. These titles are being recommended for inclusion in the next printing.

It is an excellent list, and may well become the basis of reading selections for engineers of all ages. The introduction should be read carefully as it tells not only of the committee's purposes, but something of the history of its work as well. The Institute's representatives on the junior panel of the Committee on Professional Training, which has prepared this list, are J. W. Brooks of Niagara Falls and Alphonse Ouimet of Montreal.

OPENINGS FOR ENGINEERS IN INDIA

A member of the Institute from the United States recently visited headquarters relative to certain large developments which were under way in India.

This member is the United States and Canadian representative of one of the largest companies in India. He has suggested that he might be in a position to help members of the Institute who might be interested in employment in that country. As far as employment is concerned, he thinks the interest would be restricted principally to young engineers, but for such persons he believes there are excellent openings.

He suggested also that he would be glad to make contacts for other members of the Institute who, for export or import purposes, desire to make contacts there.

At the time the member was in Montreal, he expected that an Indian Industrial Mission would come to North America within a short period of time, and that Canada would be included in the itinerary. Since then we have had no further word, but if any members are interested, either in employment or in contacts in that country, we would be glad to have them commmunicate with headquarters promptly and we will see that the information reaches the proper person.

MONTHLY REPORT ON REHABILITATION

As a result of the questionnaire sent out in March, contact has now been established with four hundred and fifty members of the Institute serving in the armed forces all over the world. Already a few have returned to their native land, and it is satisfactory to note that most of these have made Headquarters of the Institute one of their first ports of call.

The response by mail has been very gratifying, and in the belief that some of the comments will be of interest to members whose financial support has made this undertaking possible, extracts from a few of the letters received are reprinted below.

From a Flight Lieutenant overseas:

"I do greatly appreciate the interest and efforts taken by the Institute in this matter under the leadership of Dean E. P. Fetherstonhaugh; others with whom I have discussed this matter agree. The feeling is growing that the E.I.C. is gradually becoming the national association for all professional engineers, and that in the near future it will be strong enough to command respect as such, from the public and from political groups. There are many graduate engineers in the R.C.A.F. who have expressed their intention of seeking admission to membership, following their return to civilian life."

From a Flying Officer overseas:

"It is such a good thing that the E.I.C. is taking such an interest in rehabilitation. Congratulations for a good move made in good time."

From a Colonel overseas:

"I very much appreciate your letter of March 23rd, and I am sure that it would be a great comfort to all members of the Institute who contemplate returning to civil life, shortly, to know that you are taking such an interest in the question of resuming civil occupation.

"I will not fail to bring it to the notice of any other members that I may meet during the course of my duties over here and wish all success to the Institute and your staff in the work which you have undertaken."

From a Flying Officer with Bomber Command overseas:

"I have received your letter of March 23rd, and the accompanying questionnaire, and appreciate very much, the interest and consideration the Engineering Institute of Canada is taking in those members who are now on the way to demobilization."

From a Group Captain:

"I would like to compliment whoever is responsible for drawing up this letter and the questionnaire as I think a very good job of work has been done."

From a Sub-Lieutenant after his return to Canada:

"This questionnaire is certainly a very good idea and should prove most helpful to the very large number of men who have not definitely decided on their post-war career."

From an Army Lieutenant who served in Canada:

"I was very grateful to receive your rehabilitation questionnaire. I am sure this form will be greatly appreciated by members serving in the armed forces, and especially by the more recent graduates, who have only had temporary employment during the summers and have enlisted upon graduation."

From a Major-General in Ottawa:

"I appreciate very much your letter of March 23rd; I want to congratulate you on getting Howard Kennedy to take on the chairmanship of this work."

From a Captain in the Royal Canadian Navy:

"I think this questionnaire will prove of inestimable value to members of the Institute who are temporarily serving with the forces."

From an Army Captain returned from overseas:

"I think the Institute is to be heartily congratulated in the action taken in this matter and is particularly fortunate in securing Major-General Howard Kennedy as chairman of the committee."

From an Army Captain—a veteran of two wars:

"With regard to your very thoughtful letter of 23 March, it is nice to feel that one has the support of the E.I.C. behind them during the uncertain and usually difficult days of rehabilitation."

From a Flight Lieutenant serving in Canada:

"May I assure you that it is good to know of your interest, and to know that the services of the E.I.C. are there if needed."

From a Major—veteran of two wars:

"Please accept my thanks and congratulations for the action you are taking in this important work."

From a Lieutenant-Colonel at Military Headquarters, London:

"I wish to state the attitude of the Institute towards the engineers over here and the major problem of rehabilitation is most appreciated."

From a Naval Lieutenant with overseas service:

"This sounds like an extremely worth while thing, to me, and here's hoping you can make a success of it."

From a Colonel with the 1st Canadian Army:

"Many of the younger officers have had no time or opportunity to demonstrate their ability to Canadian employers before the war; consequently, unless their case is taken up by a serious body such as the E.I.C., there is a danger that some of them will suffer hardships in returning to civil employment."

From a Lieutenant-Colonel overseas:

"It was with a great deal of satisfaction that I received your letter of 23 March 1945, offering the Institute assistance in the matter of rehabilitation."

"While I expect to be re-employed by my former employer on my return to civil life and therefore do not anticipate requiring any assistance, it does indicate that serious thought is being given to post-war problems, including employment of those at present overseas.

"If any member I meet has not received such a letter, I will acquaint him with the offer made."

From a Flight Lieutenant at Air Force headquarters, Ottawa:

"I wish to express my deep appreciation for the very fine efforts of the Engineering Institute in creating a special committee for the rehabilitation of engineers. I have no doubt that this committee will prove to be of very great value."

From a Group Captain at Canadian Headquarters:

"A very good idea and one which should be of value, especially to the young engineer. I wish to thank you very much for your interest in us."

From a Sub-Lieutenant:

"It is indeed a pleasure to know that the Institute has taken steps to help its members in the services upon demobilization."

From a recently discharged sapper, R.C.E.:

"Thank you for your letter and questionnaire. It appears to be an excellent move and some of us will need it."

From a Lieutenant at sea:

"I greatly appreciate the interest the officers of the E.I.C. have taken in the rehabilitation of members serving in the armed forces.

"It is gratifying to realize that the Institute is making the necessary contacts with industry, which we will no doubt require upon demobilization. This step is, in my opinion, very necessary, as it is next to impossible for a member of the armed forces to personally apply for a position at this time."

From a Flying Officer serving in Canada:

"I'd like to thank you for giving (new employer) my name and to compliment you for the help you're giving to members of the armed forces in getting established after the war."

From a Major overseas:

"Thank you very much for giving me this opportunity of putting my case before you. It is the most positive scheme I've seen so far."

From a Lieutenant at sea:

"Your letter of 23rd March 1945, regarding rehabilitation policies was enthusiastically received. I can assure you that your interest in this our problem is greatly appreciated."

From a Flight Lieutenant serving with the Canadian coastal command:

"Might I add, gentlemen, that your interest in rehabilitation of service personnel is a very comforting factor, and will serve to ease many engineers' minds when they start to think of settling down again in civil occupation."

From a Lieutenant on convoy duty:

"The interest shown in your letter and the rehabilitation questionnaire for Institute members in the services, has been noted and very much appreciated. Now, when in the not too distant future many of us may be returning home, it is very gratifying indeed, to know that steps are being taken to facilitate our rehabilitation."

From a Lieutenant Commander overseas:

"I have pleasure in acknowledging your letter and rehabilitation questionnaire of the 23rd March 1945. It was indeed a great morale builder to receive such a form. Most forms are completed with disinterest (if they are completed at all). In this case, I assure you that it was with considerable zeal that I did the necessary paper work."

From a Lieutenant in the R.C.E.M.E. overseas:

"May I say that I am sure that this aid you are giving to ex-service personnel . . . . is going to be much appreciated. My own thanks once again to you."

From a Naval Lieutenant at sea:

"It gives me great pleasure to know that I may refer to you for assistance, as I have not had employment in industry before. Thanking you for your sincere assistance."

From a Lieutenant in the Navy:

"The Engineering Institute of Canada has gradually become more important to the well-being of engineers in Canada. After this genuine gesture of welcome shown by the Institute to the veterans of this war, there will doubtless be an even closer relation between the Institute and its members. I for one would like to express my thanks for your thoughtfulness."

From a Major with the 1st Canadian Corps overseas:

"Your letter of 23rd March regarding rehabilitation reached me some days ago, and it is indeed a comfort to learn of the efforts that are being extended on behalf of the members overseas."

From a Flying Officer overseas:

"The interest shown by the officers and fellow members of the Institute in circulating this questionnaire is greatly appreciated."

From a Lieutenant overseas:

"I have read your letter concerning rehabilitation. It is very gratifying that the Institute is so eager to help. I am sure many will have cause to be grateful to them."

From a Flight Lieutenant overseas:

"I am sure I join with the rest of the E.I.C. members over here in thanking you for the great interest you are showing towards our welfare in this regard and in wishing the Institute every success in its post-war aims."

From a Major at C.M.H.Q. overseas:

"My sincere thanks to the Institute for their interest in helping us to return to civil life."

From a 2nd Lieutenant serving in Canada:

"With reference to your rehabilitation programme, I wish to assure you that in one stroke you have probably done more to ensure the good fellowship of the Institute in future years than by any other single effort. For the younger members in particular it is very gratifying to know that responsibility is not only felt by the individual towards the Institute, but in times of need is practiced by the Institute towards the individual."

From an army Captain overseas:

"Many thanks for your encouraging letter of 23rd of March. It is grand to know that the E.I.C. is trying to help Canada equip herself for the problem of returning service men."

RESEARCH IN INDUSTRY

At the 1944 annual meeting of the Institute, Past-President C. J. Mackenzie, president of the National Research Council, delivered a most interesting and instructive paper which pointed out the need of the expansion of expenditures on research in Canada. He emphasized particularly the need of industry taking a more active interest in this field.

At the 1945 meeting of the Institute, Dr. A. F. G. Cadenhead delivered a paper along the same lines, tying it in closely to that delivered the year before by Dr. Mackenzie. This paper too stressed the desirability and the need of industry expanding its activities in the research field.

During the recent interview with Dr. C. F. Goodeve, referred to elsewhere in this issue of the *Journal*, this same need was stressed. Dr. Goodeve pointed out that, in Great Britain, there are two research workers for industry to one in the government. This was far different from the conditions which exist in Canada.

A further expansion of this same idea, but with particular application to warlike stores, was given in the seventh report from the Select Committee on National Expenditure of Great Britain, which is reproduced herewith. This report states " National economy can be firmly based only on the best outlay of the nation's resources. In this instance, your committee are in no doubt that if research and development are not maintained at a high level and encouraged by the right methods of control and co-ordination, and if terms of employment which will attract the best brains to the service of the state are not offered, the nation's bill for the equipment and maintenance of its forces in a state of fighting efficiency will be disproportionately large." Also, " Failure to evolve means of securing the closest contact between the scientist, the manufacturer, and the fighting man must inevitably lead to gross extravagance, and perhaps peril to the existence of the nation."

From these various authorities it can be seen that there is great need for further expansion in the field of research. It is to be hoped that the close contact between Canadian industry and American industry will not forever restrict to a dangerous degree the amount of research done by Canadian industry.

Seventh Report

"The Select Committee appointed to examine matters that are the subject of current expenditure defrayed out of moneys provided by Parliament for the Defence Services, for Civil Defence and for other services directly connected with the war, and to report what, if any, economies consistent with the execution of the policy decided by the Government may be effected in the expenditure thereon, have made further progress in the matters to them referred, and have agreed to the following Seventh Report.

Research and Development: Warlike Stores.

" 1. In the wide inquiries made during the last five years into expenditure on the fighting services the problem of establishing the most efficient system of providing for research and development in relation to warlike stores has constantly recurred; and much evidence specifically directed to this matter has been taken. The problem is one of great complexity, comprising not only the scientific aspects of guiding research expenditure into the most likely channels, but also intricate administrative and financial aspects. Its solution will not be achieved by a few simple adjustments of existing Government machinery.

" 2. One of the main lessons of modern war has been the essential need for maintaining the closest contacts between all three fighting services and a fully co-ordinated control over their operations in the field. The necessary corollary to this is the establishment of similar contacts and controls in the field of their supply services and of the basic research upon which these in their turn must rely. In the circumstances existing at the outbreak of war each fighting service was primarily responsible for developing, through its own supply organisation, the weapons and stores it required. This system inevitably resulted in parallel and not fully co-ordinated advances in certain fields where more than one service was interested. In the result, there has been a certain degree of overlapping, in spite of later efforts made to minimize this by means of inter-service committees. Attempts to solve these major problems of administration and Government organisation must lead to reconsideration of the present allocation of departmental responsibilities. These are matters outside the scope of Your Committee; but, having in mind the outcome of continuing inquiries throughout the war, they would be failing in their duty to the House if they did not report their conviction that these problems must be squarely faced and attacked with the least possible delay.

" 3. Similarly, on the financial side there are considerable difficulties to be overcome, which may well call for a detailed re-examination of the methods at present employed for the voting of money for research and of accounting for its expenditure. Again, these are questions which lie more within the scope of the Committee of Public Accounts than of the Select Committee on National Expenditure. Nevertheless, the inquiries made by the Select Committee during this war have heavily underscored the fact, already long known to those who had direct experience of applying money to research, that the methods of control and accounting most suitable to ordinary administrative expenditure are not necessarily those that lead to the most fruitful achievement of results in research. In particular, money voted for research cannot be most advantageously expended if it is tied down by a detailed and rigid annual estimate. What is needed is that block grants should be sanctioned for specified periods of years. The detail of the expenditure actually incurred out of such grants would, however, have to be accounted for at appropriate periods. The parliamentary control of this type of public expenditure is a subject which might well, in the first instance, engage the attention of such a Select Committee as that recommended in the Eleventh Report of the Committee of last Session*; and Your Committee again draw the attention of the House to the real need for the appointment of such a committee.

" 4. In addition, there are the further problems of securing the maintenance, both in industry and under Government control, of active and fully skilled organisations, together with the necessary machine tools and equipment, for the development of the new results flowing from establishments concerned with basic re-

* H.C. 122, 1943-44: "The Examination of National Expenditure"; paragraph 17(i) "That in the forthcoming Session a Select Committee should be appointed to inquire into the means of securing the most effective examination and control by Parliament of public expenditure."

search and for the carrying out of specific applied research, and the linking up of all these establishments in such a way that the fullest unity of purpose can be maintained between research, manufacture and operational requirements. It is of first importance that the permanent cadre of the fighting forces should always have available during peace-time an adequate quantity of the most up-to-date weapons and stores that continuing research and development can provide, not merely for the purpose of training and for use in any war in which the country might become involved, but because by field experience the fighting man can himself play an important part in the most effective development of war material. Moreover, the results of this experience should be fully shared with the Dominions. The present system for co-ordinating research and design between this country and the Dominions should be continued in peace-time, and the Dominions should be invited to co-operate intimately at all stages of research, design, development, production and trial.

" 5. These are no light matters. Many examples of wasteful expenditure on warlike stores of all kinds, which it would serve no useful purpose to enumerate, have been brought to the notice of the Select Committee from time to time. Taken together, these conclusively show that the daily cost of this war, at least during the earlier years, was unnecessarily increased and the duration of the war prolonged because of three simple facts—

(i) that research had for long been starved;

(ii) that adequate steps had not been taken to maintain during the years of peace a nucleus of skilled men which could be rapidly and efficiently expanded for the purposes of war; and

(iii) that the system of departmental responsibility was not sufficiently flexible fully to meet the changed requirements.

" Your Committee fully recognise that in spite of these heavy disabilities excellent results have in many instances ultimately been achieved by ingenious and sensible improvisations and by the unremitting work of innumerable individuals and organisations in science, industry and the public service. But this does not weaken the force of the conclusions stated. An excellent example of the results that flowed from the prosecution of active research during the years before the war is to be found in the development of the Hurricane and the Spitfire, which had already by the outbreak of war been brought to a state when they could be put into immediate production. What the possession of these aircraft, developed on the initiative of the aircraft industry, meant to this country is a matter of history.

" 6. It is no part of Your Committee's duty to indulge in a historical analysis of why the state of affairs existing in 1939 had been allowed to develop. They are concerned solely that the same mistakes should not be repeated. In this connection it must in justice be emphasised that, though the Select Committee have, from the nature of their task, had to direct criticism to many fields of war expenditure, they have seldom found cause for complaint in the discharge of official duties by the individuals entrusted with carrying these out. The inquiries here briefly reported have proved no exception. Critical examination has revealed weaknesses inherent in the system and roughness in its machinery rather than failures in the execution of allotted tasks. It can be said that these weaknesses should have been foreseen; but the only practical consideration is that, having now been fully recognised, immediate and vigorous action should be taken to put them right.

" 7. On the narrow view, it can be argued that under their orders of reference it is not for a Select Committee on National Expenditure to recommend the increased disbursement of public money. Your Committee and their predecessors during this war have unhesitatingly rejected this view. National economy can be firmly based only on the best outlay of the nation's resources. In this instance Your Committee are in no doubt that, if research and development are not maintained at a high level and encouraged by the right methods of control and co-ordination and if terms of employment which will attract the best brains to the service of the State are not offered, the nation's bill for the equipment and maintenance of its forces in a state of fighting efficiency will be disproportionately large, and that in the long run uneconomic restriction in research expenditure and the failure to evolve means of securing the closest contacts between the scientist, the manufacturer and the fighting man must inevitably lead to gross extravagance and perhaps imperil the existence of the nation.

" 8. Owing to a parsimonious attitude towards research and consequent unpreparedness, the first two or three years of the war were spent by scientists and research workers in a strenuous attempt to make up for lost time. Consequently, lessons from the battlefield could not be applied in time for the new weapons so urgently required to reach the hands of the fighting forces during the most critical years. The recurrence of these difficulties can be prevented only by securing the technical initiative during the years of peace and successfully welding this to the war potential. Technical initiative may be defined as the ability to develop and maintain maximum weapon-power technique and to evolve strategic policy accordingly. War potential, on the other hand, is the reserve of manpower, economic resources and the extent to which both can be effectively mobilised in an emergency. Time is also an essential factor in the development of war potential, as the industrial capacity available must be capable of immediate conversion from peace to war purposes on the outbreak of hostilities if it is to be utilised to the full. The rate of this conversion depends on planning and bears a very intimate relationship to technical initiative. Technical initiative, however, will not be maintained in war solely by providing the forces of this country with weapons at least equal to those of the enemy—vital though this requirement is. It is equally essential to have at the service of the State trained scientists, inventors and manufacturers whose continuing preoccupation with the problems of warfare will render them the more capable of speedily producing antidotes to new and unsuspected enemy devices. Production binds the thought of the scientist to the weapon of the fighting man.

" 9. In the face of an impending dissolution of Parliament there is no time to deal with this most important matter in the detail which it demands; but Your Committee recommend that this should be one of the first problems to which the new Parliament should address its close attention."

CANADIAN SCIENTIST REVISITS CANADA

Tells About Developments of the War

On the 23rd of June the Institute had the pleasure of a call from Dr. C. F. Goodeve, O.B.E., F.R.S., a graduate of the University of Manitoba who, since 1927, has been in England and is now senior executive at the British Admiralty for research and development. Dr. Goodeve has been visiting Canada in connection with postwar plans for research and development which are of naval interest.

In looking to the future, Dr. Goodeve stressed three things—one, the great increase in technical knowledge brought about by the war, which will lead to improvements in the ways of life for all people—two, the increased appreciation on the part of the government and of industry of the uses and value of science,—and three, the increased ability of scientists and engineers themselves to apply their knowledge quickly and efficiently for the benefit of mankind.

He is of the opinion that conditions in Canada would be somewhat similar to those in England as far as the use of science and engineering was concerned, but he pointed out that the great increase in scientific knowledge in Canada has been restricted largely to government organizations, whereas, in the Old Country, a great deal of the advances had come through the employees of private industry. He referred in particular to the research work done in Canada by the National Research Council and the Department of Mines and Resources. He thought that the work done in these two organizations was as good as could be found anywhere in the world. He stressed, however, the need of industry applying itself in the research field if Canada was to receive the full benefits to which it was entitled.

Dr. Goodeve referred to the great advances made by Canada's industry. The country was now one of the first in industrial importance, but he was of the opinion that it will be a great problem to maintain that position unless industry expanded its interest in research.

In reply to questions, Dr. Goodeve disclosed a great deal of interesting information relating to developments during the war, many of which are not generally known. He prefaced his replies with the statement that his knowledge was limited largely to the work which had gone on in the Navy, although the adoption of similar ideas by the Air Force had given him some knowledge in that field also.

He stated that Great Britain had been responsible for 90 per cent of the new developments for the Allied Navies and Air Force. He pointed out that there were some few exceptions to this, but emphasized that the leadership in the thinking which had solved so many of the war problems had come from the Old Country.

For example, Dr. Goodeve stated that all anti-submarine methods were of British origin, with the exception of one which was entirely a Canadian idea and development. This latter item is still on the secret list, as it was expected that it would take a great part in the activities in the Far East.

He pointed out that, in the beginning, submarines were sunk mostly by the Navy, but as methods improved, the Air Force took a more active part, until, at the height of its success, it was accounting for one-half of all submarines sunk.

Several questions were asked of Dr. Goodeve relative to Radar. He explained that this had resulted from an accidental discovery. It seems that in experimenting with television, an image was seen to pass across the screen, which upon investigation proved to be an aeroplane that had flown through the field in which the television set was working. This led to further investigation, and eventually by using the broadcast beam to Australia, very complete experiments were carried out and the whole system established. This was in 1935.

In the early days it was thought that the wireless waves were not less than 50 feet, whereas at the present time they had been discovered down to lengths not more than the size of one's thumb. Dr. Goodeve declined to be specific on this point, as he said the actual figures were still very much on the secret list.

By means of the use of very short wave lengths, it was possible to control broadcasts very closely. A short broadcast could be sent out on a straight line so that it could not be picked up beyond the point it was designed to reach, and also would not interfere with other conditions surrounding the area. For example, he mentioned the broadcasting from one end of a train to the other, which he said could be done on straight beams on very short wave lengths without interfering with any other radio or atmospheric conditions through which the train might pass.

He gave great credit to Canada for its share in developing Radar. As a matter of fact, he thought Canada's part in the development of this great discovery was even greater than that of any other country, when considered on a population basis. He gave particular credit to the National Research Council and Research Enterprises Limited for their part in it. Dr. Goodeve explained that he has toured Canadian industry over a wide field, and he has been disappointed to see the small part in research development that had been undertaken by the industries. He hopes that this did not indicate that industry in Canada was not research-conscious.

In Great Britain the numbers in research were divided roughly into one man in government service, and two men in industry, and one-half in the universities. He thought these figures would indicate to Canadians the great need of industry increasing its interest in this subject.

Dr. Goodeve was decorated with an O.B.E. partly in recognition of his methods for sweeping magnetic mines. Erroneously he has been credited with this decoration for work on degaussing, but he explained carefully that all he had had to do with this subject was to pick on the name. Previously to naming it had been referred to as de-magnetizing, and he thought it was a bit awkward for the ships' crews. As a unit of magnetism was named after Gauss, the German scientist, he thought the word degaussing would be an appropriate one, particularly as it would not be difficult for the crew to handle because of their familiarity with the word " delousing ".

Dr. Goodeve has written a paper on his sweeping methods, disclosing a good deal of technical material which previously was not available. The *Journal* hopes to print some or all of this in a subsequent edition.

In the " Battle of the Mines ", which Dr. Goodeve said was the first victory of British scientists over the enemy, many interesting things occurred. When it was discovered that the magnetic mine was detonated by the vertical tilting of a horizontal needle due to the entry in the magnetic field of a metallic body, such as a ship, it was decided to so equip the ship that it would exert a downward pressure rather than a vertical pressure when entering such a field.

From this, the degaussing methods were devised However, in three or four months' time, when the enemy discovered the degaussing system, they changed the mechanism on some mines so that they would detonate on a downward pressure, and from then on sowed mines of both types.

The next development in the magnetic mine was the delayed detonator, which required that the mechanism be tripped any number of times from one to ten before it finally fired the mine. This mechanism could be set so that a minesweeper passing over it would only count as one tripping. It might take ten sweepings before it finally exploded, or it would take less if the mechanism were set accordingly.

Dr. Goodeve said that this device did not produce very great dividends, although it did disturb the Navy considerably, due to the fact that they never were sure whether or not a passage was swept clear. It meant that the sweepers had to go out at least ten times over the area, and that each time they went out, some of the mines were exploded. Once the mechanism was discovered, it simply meant that more sweeping had to be done.

As to mines and torpedoes that acted acoustically, Dr. Goodeve said that they had been unable to obtain any of these intact until the invasion of Germany. However, from their action they knew of the mechanism and what activated them. He explained that these instruments were equipped with two ears, one protruding on each side, and their direction was controlled by the noise of a propeller on a passing ship. Once the pressure from the sound was equalized on both sides, it went in a straight line towards the propeller. Any changes in direction of the ship were compensated for by equalizing the pressure on the ears. Eventually, the charge was detonated against the stern of the ship.

Dr. Goodeve was not very specific in describing the methods that were used to offset these attacks. He simply stated facetiously that the answer consisted of making a noise that sounded like a ship's propeller some place where there wasn't any ship.

In conclusion, Dr. Goodeve stressed the great need there was for further developments in the field of electronics. In Great Britain, he thought that at least 50 per cent of all scientists were now working on this field. He thought it was necessary that greater numbers of scientists apply themselves to the subject in Canada. He thought Canada was fortunate in the numbers and the quality of its scientists and engineers, but he hoped that industry would not miss the opportunities which are afforded it now to establish for itself a permanent place in the world's business.

WASHINGTON LETTER

San Francisco

As this is written, the San Francisco Conference is drawing to a close with most of the major issues either settled or compromised. The draft of the final Charter has been published and President Truman is on his way to make the final address. The conference has been a difficult and stormy one. Australia's Dr. Evatt has played a prominent part, particularly with respect to the vexed questions of trusteeship and veto power. As one commentator put it, Dr. Evatt "has turned out to be the most effective small nations' operator at San Francisco. He picked up the ball and—gave the Big Five a real run for their money." All in all, the Conference would appear to have been a success. It is too early to comment with any assurance, but Field Marshal Smuts' sober commendation is probably as close to the mark as possible. The South African Field Marshall is the only living link between the chief drafters of the Covenant of the old League of Nations and the drafters of the present Charter for a new world league. Smuts wisely points out that points of contention received the publicity, but that the great bulk of the work of the Conference, in which a very considerable degree of unanimity was reached, is likely to go unnoticed. In contrasting the old League Covenant with the present Charter, he summarizes the main points of the Charter as follows: great power leadership for peace; great power unity, as provided by a voting arrangement made at Yalta; the obligation of all states to join with force against aggression; and regional groups for defence, in default of action by the world organization. All these main features have been accepted without demur by the fifty United Nations involved. Thus does the present charter give effect and force to principles which were merely recognized in the old Covenant. Even more than the old Covenant, the Charter provides for human welfare and progress. Most important in the scheme of things will be the new Economic and Social Council. The chapter on trusteeship is also worthy of close attention. If the old League Covenant was conceived in a spirit of idealism following the last war, it seems fair to say that the new Charter has been drawn up with a background of much greater realism, and certainly much greater experience. Being widely quoted on the subject of the conference is Benjamin Franklin's famous speech at the conclusion of the Constitutional Convention of 1787—"Thus I consent, Sir, to this constitution because I expect no better and because I am not sure that it is not the best—On the whole, Sir, I cannot help expressing the wish that other members of the Convention who may still have objections to it, would with me on this occasion doubt a little of his own infallibility, and, to make manifest our unanimity, put his name to this instrument."

Month's Highlights

In addition to the San Francisco Conference, some of the highlights of the news of the past month might be recorded as follows. The Trade Agreements Act granting the President the power to reduce tariffs by a further fifty per cent has been passed by both the House and the Senate after a very stormy passage and after strong intervention by President Truman on behalf of the Bill. Pressure is growing for the calling of an International Trade Conference. The House has approved the Bretton Woods Monetary Proposals by a vote of 345 to 18, and the proposals now go to the Senate. The repeal of the Johnson Act is now before the Senate Finance Committee, and a favourable report is expected. President Truman has made three major changes in his cabinet which have been generally applauded. The President has also taken steps looking to alteration of the present rules regarding Presidential Succession. Hearings have commenced in Congress on the "Full Employment Bill" which aims to establish a national policy and programme for full employment in a full competitive economy. Top military and naval authorities, in recent testimony before Congressional Committees, have come out strongly in favour of a programme of universal military training in the post-war period. Following the original establishment of priorities to assist the automobile industry to get back into production, the War Production Board has now authorized the manufacture by ten automobile companies of 691,018 passenger cars between July 1st, 1945, and March 31st, 1946—a considerable increase over quotas originally anticipated. War Production Board Chairman Krug has issued a long report on reconversion policy for free industry. The activities of the Office of Price Administration have been under close scrutiny and some curtailment or transfer of power may be expected. The Canadian election resulted in a victory for the Liberal Party. The Hon. Ben Smith, British Minister for Supply in Washington, has returned to England to contest his seat in the forthcoming British elections. He will be greatly missed in Washington. Colourful and influential General Knudsen has retired as Production Chief for Army. Another high spot in the last week has been the tumultuous reception given to General Eisenhower, particularly by New York and Washington. It is estimated that a crowd of some four million persons welcomed the general in New York, and that over a million turned out in Washington—considerably more than the total peacetime population of the city. Both receptions went far beyond any previous record for two cities which rather pride themselves on receptions to returning heroes. The general's speeches have been worthy of the man and the occasion and will bear close study. A week earlier the general had been given the freedom of the city of London and the Order of Merit.

"Operation Pluto," Etc.

As the censorship ban is being progressively lifted, the number of "now-it-can-be-told" stories is increasing. One of the most interesting recent instances is the publication of the details and the release of an excellent film on the oil lines laid under the English Channel. This project has been known as "Operation Pluto". The project was designed and executed by English engineers, and is said to have grown out of a suggestion made by Lord Louis Mountbatten as far back as 1942. The first flexible steel pipe lines were laid in time to supply gasoline in the early days of the Normandy invasion. Eventually some twenty lines were laid, some of them running all the way from Liverpool to Frankfurt in Germany. Because of the secrecy surrounding the operation, pumping stations were concealed in old and innocent-looking farm houses and villas. It is estimated that more than a million gallons of gasoline a day were pumped directly to the allied armies. The importance of the use of "Jerry cans" for the transportation of gasoline in ensuring the success of the African campaign was mentioned in a previous Washington letter. "Operation Pluto" is another incident in this most important and specialized supply programme. Several other releases in the scientific field may be of interest. The announcement has been made of the Bunyan-Stannard "envelope" dressings for burns which completely enclose the affected area in a solution of sodium hypochlorite. A Bailey bridge over 1,000 ft. long has been built to span a river in Burma. The Committee on Human and Animal Trypanosomiasis has announced distinct advances in control of the dread diseases, and in the control of the Tsetse fly. Not only has the Committee announced discoveries which will be effective in controlling the diseases and thus liberating the vast areas hitherto contaminated by them, but on the curative side the Committee has announced the discovery of a drug which it is expected will destroy the sleeping sickness parasite. At least descriptive details are beginning to appear with respect to some aspects of radar, degaussing, the new naval rockets, and asdic (submarine detection).

Glen Martin Plant

It was my privilege recently to accompany several Australian visitors on a tour of inspection of the large Glen Martin aircraft outside of Baltimore. This is one of the largest aircraft plants in the East. Great areas of free floor space has been provided by what must be something of a record in roof trusses for industrial buildings. I was also very impressed with the "jig and fixture" layouts which have been developed. One is made keenly aware that some of the spectacular techniques developed by the United States aircraft industry are dependent upon the tremendous volume of production which has been handled. Complete hull templates with "built in" jigs and fixtures were prepared for all the various stages in the production of the hull. This massive construction extended along the length of one of the shops and one climbed about it on an intricate series of ladders and catwalks. In common with all aircraft plants, present production has been considerably cut back. The most spectacular remaining operation in the Glen Martin plant at present is the construction of the giant "Mars" flying boat. To see the great hull of this "ship" towering about thirty feet above the floor of the shop and resting in the forest of template work which constitutes its cradle, is a most impressive experience.

E. R. Jacobsen, m.e.i.c.

FOUNDING OF A BRITISH EMPIRE LECTURE

An official notice has been received from the Royal Aeronautical Society advising the Institute that a new endowed lecture had been established by the Society, and asking that engineers in Canada be informed of it.

The Lecture, on any aeronautical subject approved by the Council of the Society, will be delivered annually in September in London by a lecturer chosen, in alternate years, from the British Dominions and Colonies and Great Britain.

The Council, by founding the British Empire Lecture, are anxious to encourage new ideas and new points of view from all parts of the British Empire, and to make the lecture second only in importance to the Wilbur Wright Memorial Lecture.

The British Empire Lecture will have a premium of £50 attached to it, and in the case of lecturers coming from the Dominions and Colonies, an allowance up to £100 will be paid towards the lecturer's expenses. It is proposed to hold the first lecture in September, 1945.

This is an attractive proposal, and it is hoped that the names of Canadians will figure prominently in the competition. You may send your suggestions to J. Laurence Pritchard, Secretary, The Royal Aeronautical Society—4 Hamilton Place, London W.I., England.

A UNIQUE OPPORTUNITY FOR INDUSTRY

H. G. Cochrane, M.E.I.C.

In the June issue of the *Journal*, there appeared a short article giving credit to the Wartime Bureau of Technical Personnel for the part it has played in directing technical personnel to the war effort. A measure was also given of the magnitude of the post-war task confronting it, to get all these scientists and engineers back into peacetime industry and in their right grooves.

It now appears possible that the Bureau will be maintained as a going concern at least for the periods of demobilization and reconversion. During this time, it will be " operating in reverse " to what it has been doing over the past four years. In other words, primarily it will be functioning as an employment agency for technicians, for the purpose of serving industry in helping it to rebuild its technical staffs, and of serving individuals in the professions, by finding them suitable employment in peacetime jobs. There is no thought here implied of detracting from the need or value of other technical employment services such as those conducted by the E.I.C., the Technical Service Council, the Queen's Alumni Service, or others maintained by faculties of the various universities. Cooperation between these and the Bureau can be maintained to mutual advantage.

On the one hand there are some thirteen thousand technical persons, either members of the Armed Forces or temporarily placed in war industries, who will be seeking peacetime jobs. Their morale is high from the sense of accomplishment from realization of a job well done. The ones in uniform are adventurous, have been to far places and have seen other ways of doing things. The stay-at-homes have learned what long hours and hard work mean. They are adaptable, they haven't been travelling in any rut. They are nearly all younger men. Many of them are wartime graduates of universities. The records of their qualifications are all on hand with the Bureau.

On the other hand, now is an ideal time for industry, particularly the larger employers of technical persons, to give serious thought to staff rebuilding. If these departments and industrial concerns were to give some intensive study now to their longer term requirements they would be impressed with the urgent need of infusing their technical staffs with younger men. For reasons of economy during the depression years of the " thirties," and later throughout the war years when the armed services were getting the cream of the supply, little recruiting of technically trained personnel from the junior brackets was possible. Today these concerns are starved for younger men. The average age of technical staffs is about ten years higher than it should be.

The Bureau has been making an exhaustive actuarial analysis of the material contained in their 36,000 personal records. Broken down by categories, there are found to be some 5,400 civils, 3,950 chemists, 3,900 mechanicals, 3.800 electricals, 2,600 mining, 2,050 agricultural, and 1,850 chemical engineers, 1,550 physicists and 1,400 architects, with the balance about equally divided among nine other categories.

It is found that 20 per cent of the numbers recorded will reach pensionable age of 65 years by 1955, though this is not the whole story, for it must be taken into account that the average life expectancy of technicians is probably several years less than that retirement age. Files of a group of employees in ten of the largest Canadian public utilities who employ a relatively much larger proportion of technicians than the average, have been carefully scrutinized, and it was found that even if all of these employees remained at their jobs until retirement age, these utilities would be faced with the necessity of renewing one-third of their entire engineering staff over the next ten years. Due, however, to the impact of death, disability and loss, the actual replacement would approach much nearer to one-half of their technical staff.

Another pertinent and perhaps alarming discovery is that, while the some forty-five per cent of all technical persons on record in the Bureau are over forty years of age, seventy per cent of the technical staff of the largest utilities are forty plus. Compared with this, the analysis of ages of groups in wartime industries predominantly engaged in the field of chemistry and allied categories shows that only around twenty per cent exceed the age of forty. This, of course, can be explained by the fact that chemical engineering has more recently come into prominence as a career for engineers, and also because technicians for the manufacture of such wartime necessities as explosives, shell manufacture and similar production carry so high a priority rating that draft deferments have been more readily given for younger technicians of military age.

Records show that twenty of the largest employers of technical personnel — railways, power companies, urban transportation—employ a fifth of all our engineers and scientists. Full replacement of over-age men due to retirements and loss in this group over the next ten years should absorb more than three thousand, or at least a quarter of those becoming available in the rehabilitation and reconversion period. Organizations which assess their needs and enter the market early will get the best choice. Signs point to a " sellers market," for the problem is one of shortages. Nevertheless, industry will find it easier from now on to fill its requirements, for even though certain priorities in employment must remain until V-J Day, rehabilitation can over-ride priorities.

It will indeed be unfortunate if industry fails to take advantage of this opportunity. Higher salaries across the border will attract many of our best young Canadian engineers who may not find jobs readily awaiting them in their own country. The United States looks to the same active postwar production as we do, but during war years their universities have been wholly converted to training for war with the result that their shortage of younger engineers is relatively much greater than Canada's. These technically trained young men are the greatest and most valuable of our resources. Canada needs every one of them. We should try to keep them in Canada.

It would be unfortunate if the Bureau were not retained as a going concern until this group of engineers and scientists is fully absorbed into our peacetime economy. No number of newly formed technical employment services, lacking the centralized records the Bureau possesses and its wartime placement experience, can replace its value as an intermediary to turn technically trained brains into industrial production. There is no satisfactory substitute for the organization, experience and centralized records afforded by the Bureau. Any proposal to turn this service over to a non-professional organization will be to render it wholly " null and void."

MEETING OF COUNCIL

A regional meeting of the Council of the Institute was held at the Hamilton Golf and Country Club, Ancaster, Ontario, on Saturday, June 9th, 1945, convening at ten thirty a.m.

Present: President E. P. Fetherstonhaugh (Winnipeg) in the chair; Vice-Presidents E. V. Gage (Montreal) and C. E. Sisson (Toronto); Councillors H. E. Brandon (Toronto), R. S. Eadie (Montreal), A. E. Flynn (Halifax), W. H. M. Laughlin (Toronto), Alex. Love (Hamilton), A. W. F. McQueen (Niagara Falls), C. A. Peachey (Montreal), H. R. Sills (Peterborough), J. A. Vance (Woodstock); General Secretary L. Austin Wright and Major D. C. MacCallum, the recently appointed rehabilitation officer at Headquarters.

There were also present by invitation—Past Vice-President E. P. Muntz (Hamilton); Past Councillors J. G. Hall, of Toronto, and H. J. A. Chambers, H. A. Lumsden, W. L. McFaul and F. W. Paulin of Hamilton; M. J. McHenry (Toronto), chairman of the Committee on International Relations, and J. B. Stirling (Montreal), chairman of the Committee on Professional Interests; P. A. Pasquet, secretary-treasurer of the Niagara Peninsula Branch; Norman Eager, chairman, H. A. Cooch, immediate past-chairman, A. R. Hannaford, vice-chairman, W. E. Brown, secretary-treasurer, E. T. W. Bailey, E. G. Wyckoff and G. L. T. Vollmer, members of the executive, and J. R. Dunbar, T.S. Glover, W. Hollingworth, J. J. MacKay and Stanley Shupe, past-chairmen of the Hamilton Branch.

In welcoming the councillors and guests, President Fetherstonhaugh expressed his pleasure at seeing such a good turnout, which is most encouraging to the officers of the Institute. He hoped that everyone present, whether a member of Council or not, would feel free to take part in all discussions.

Rehabilitation of Members in the Armed Services—Major D. C. MacCallum, the Institute's rehabilitation officer, reported on the work which had been completed and additional work which was planned for that activity. He gave figures to show the information which had been gathered from the questionnaires sent to members in the active services, and he also outlined proposals which the advisory committee, under the chairmanship of Major-General Howard Kennedy, had in hand. This was accepted as a progress report.

Committee on Professional Interests and the New Council—The chairman, J. B. Stirling, informed Council that his committee was of the opinion that the membership in general should be informed of the developments which had led up to the Committee's recommendation that the Institute should not participate in the new council which had been established recently by eight other organizations under the title of Canadian Council of Professional Engineers and Scientists. He then read to the meeting a statement from the committee which had been approved by the president, and which he was asking to have printed in an early number of *The Engineering Journal.* (see p. 391, June *Journal*). He thought the statement was a fair and frank acknowledgement of the situation and that the membership should be so informed in case the Institute should be criticized for seeming not to support co-operation.

Mr. Brandon inquired as to how far the new organization had advanced, and the general secretary in reply stated that an organization meeting had been held in January at which Mr. W. P. Dobson had been elected president, and Mr. H. W. Lea, secretary, The eight organizations participating are as follows: Dominion Council of Professional Engineers, Canadian Institute of Mining and Metallurgy, Chemical Institute of Canada, American Institute of Electrical Engineers, Canadian Society of Forest Engineers, Canadian Institute of Surveying, Royal Architectural Institute of Canada and the Institute of Radio Engineers.

He had been informed that offices had been set up in Ottawa and a staff engaged.

Mr. MacKay inquired as to the purposes of the new Council. Mr. Stirling replied that this was a point upon which his committee was not entirely clear. From the literature which had been supplied he was of the opinion that the objectives were vague and visionary. Its principal object seemed to be to establish a lobby in Ottawa to take care of the interests of the profession in regard to new legislation. He stated that his experience in other national organizations that had similar objectives had been disappointing. He referred to organizations, with much greater resources than the engineers and scientists could gather, that had failed absolutely in such objectives. He did not think that the Institute should participate in a pressure group functioning, at least partly, in a political field.

In response to Mr. Stirling's request the general secretary referred to organizations in the United States which had been established with similar objectives. In at least one of these cases the organization was extremely well financed and set up with a well-staffed office in Washington. Eventually the office was closed and the organization dissolved because of the entirely unsatisfactory results obtained. He had been informed on excellent authority that the organization had promoted disunity rather than unity and had failed in its objectives.

Professor Flynn referred to the committee's recommendation that the Institute co-operate first with engineering bodies before extending the co-operation to a miscellaneous group. He was of the opinion that the engineers were thrown in with scientists and other similar workers and thought it would be an advantage if some means of co-operation were established.

In reply, Mr. Stirling pointed out that the committee had recommended to Council, and Council had accepted, a proposal that a presidents' conference committee be established which could function to meet all emergencies that were of common concern. The advantage of the committee, as opposed to the present council, was that each organization paid its own expenses and that the presidency and the secretaryship revolved regularly among the participating bodies. He felt these points were important because the present proposals of the new council would lead to substantial expenditures, particularly for a large organization such as the Institute which would be called on to pay a portion of the cost which was out of keeping with the portions assigned to smaller organizations. He also thought that a revolving system of selecting officers was essential in order to avoid domination or the accusation of domination by any one.

He pointed out that the only co-operative organization that seemed to have any success at all was the Engineers' Council for Professional Development and its success had been made possible only by careful adherence to vital principles such as those which he had outlined, and which were not included in the policy of the new council.

Mr. Peachey asked as to how many of the members of the new council were professional engineering bodies.

In reply Mr. Stirling stated that only The Engineering Institute of Canada and the provincial professional associations were strictly professional engineering organizations, but he pointed out that four of the eight provincial professional associations had refused to support the new council.

Mr. Vance, as a member of the Committee on Professional Interests, moved the adoption of Mr. Stirling's report, which was seconded by Mr. Peachey and carried unanimously.

Mr. Hall complimented Mr. Stirling on the excellent work which had been done by his committee. He referred in particular to the relations between the Ontario Section of the American Society of Mechanical Engineers and the Institute following the signing of a co-operative agreement in 1943. He thought that the relationships had been greatly improved and that in the future considerable co-operative work could be carried out.

Community Planning—At the last meeting of Council, following the acceptance of the report of the interim committee on community planning which, among other things, had recommended that the Council of the Institute establish a central committee on community planning which would work with committees of the various branches of the Institute across Canada, it had been left with the president, Vice-President Armstrong, and the general secretary to select a chairman for such a committee. Up to the present time it had not been possible to find the right man with the necessary time available, and it was suggested that the members present might give the matter some consideration and forward to the general secretary the names of any persons whom they thought would be suitable and who would be able to devote the necessary time to such an undertaking.

Central Heating—Mr. Wright referred to the subject of central heating in relation to the various community planning projects which are now under consideration. It had been recommended to Headquarters that a committee be set up to gather what information is available on the subject so that it might be used by the central committee on community planning. Considerable discussion followed and many members were of the opinion that the Institute could make a worth while contribution if it appointed a committee to study this particular phase of community planning. Accordingly, on the motion of Mr. Vance, seconded by Mr. Laughlin, it was unanimously resolved that such a committee be established, with the president naming the committee.

Mr. Sisson reported briefly on a meeting of the National Construction Council of Canada, which he had attended recently as the Institute's representative and at which community planning had been discussed. Mr. W. A. Mathers had given a talk on the subject, which he had been asked to prepare in printed form so that it could be circulated to the persons attending the meeting. Mr. Sisson had hoped to have had a copy of this talk for presentation to Council at this meeting, but it was not yet available. He undertook to send a copy to the general secretary as soon as he received a copy himself.

Bennett Memorial Fund—The president reported that Councillor Vance had accepted the chairmanship of a committee to investigate the best means of setting up a memorial prize or fund in honour of the late Harry Bennett. Mr. Vance reported that considerable thought had been given to the matter, and he hoped before very long to be able to make some definite recommendations to Council.

At one o'clock the meeting adjourned for lunch, and reconvened at two forty-five with the president in the chair.

Increase in Fees and Branch Finances—For the information of Council, the general secretary reported that the Finance Committee was now preparing a memorandum to be sent to all branches regarding a proposal to increase the annual fees, and giving also certain information relative to branch finances. Recent branch reports show that some branches find it difficult to operate on their present rebates, while others have surpluses. The Finance Committee, before preparing its report on the proposed increase in fees, would like to have suggestions and recommendations from the various branches as to the amount of money needed and the purposes for which it would be used.

Proposed Student Conference—The general secretary reported briefly on the progress being made in regard to the student conference which it is proposed to hold at the time of the annual meeting of the Institute. The proposal now is that the Council shall invite the presidents of the under-graduate engineering societies to attend the annual meeting of the Institute, and to hold a one-day session previous to the annual meeting to discuss their own affairs. Replies to a preliminary enquiry had been received from nearly all of the universities, all of which had been enthusiastically in favour of the proposal and all were willing to pay some share of the cost. Correspondence is now under way with regard to all details. This progress report was noted.

Additional Councillor for the Toronto Branch—A letter was presented from the secretary of the Toronto branch advising that it had been decided by the executive that Mr. H. E. Brandon, whose two-year term as councillor ended last February, should be reinstated to complete a three-year term, thus giving the Toronto branch the third councillor to which it is now entitled.

On the motion of Mr. Vance, seconded by Mr. Laughlin, it was unanimously resolved that Mr. Brandon be so appointed.

"Mulberry" Harbour Exhibition—The general secretary stated that, since reporting to Council at the May meeting, further information had been received relative to the proposal to bring to Canada the model of the "Mulberry" prefabricated harbour which had made possible the invasion of Europe. The new information stated that the exhibit was now in Paris but would be shipped to Canada in time to arrive in Montreal in August. In advance of the arrival of the exhibit, the British government would send Colonel Speers Webster, who had been associated with the project since its conception, so that more complete details could be arranged.

The government would also send six attendants with it who would take full responsibility for setting up and taking down the exhibits.

The route which had been proposed tentatively, in consultation with the general manager of the Hudson Bay Company, was Montreal, Ottawa, Toronto, Winnipeg, Calgary, Edmonton, Vancouver, Victoria, Quebec and Halifax.

Mr. Wright thought consideration should be given to showing the exhibition at such centres as Windsor, London, Hamilton and Saint John, in addition to those already listed, providing, of course, that the branches at those centres would like to have it and could arrange for suitable space.

The president wished to have Council's further consideration of this proposal, but thought it was an excellent thing for the Institute to undertake. He thought care should be taken to get all details reasonably established with regard to expenses.

Mr. Muntz inquired as to the suitability of the Department of National Defence as an agency to handle the exhibit through the armories in the various places as the exhibition centres. The general secretary thought that more people would be able to see the exhibit if it were more centrally located in such places as large departmental stores where such were available.

Mr. Brandon was of the opinion that the surroundings in the armouries made them quite unsuitable for such purposes. Mr. Hall recommended that Council agree to the proposal but leave the final decisions and the details to a committee to be appointed by the president. Out of this proposal it was suggested that a committee be established under the joint auspices of the existing Committee on International Relations and the Papers Committee.

Eventually it was moved by Mr. Eadie that Mr. Sisson and Mr. McHenry be asked to act as joint chairmen, with power to add to their number, first of all to look into the financial obligations and the amount of work involved, and then to arrange with the various branches for the handling of the exhibit in the different centres. Mr. Eadie's motion was changed later to recommend that Mr. Sisson be chairman and Mr. McHenry, vice-chairman of the committee. This was seconded by Mr. Peachey, and carried unanimously.

Technical Institutes—The president reported that he had received a letter from the Royal Commission on Education (Ontario), asking if The Engineering Institute of Canada would care to make a submission either in writing or orally. The president read a letter from Dean Young which recommended that the Institute make a submission relating particularly to the establishment of technical institutes.

Following some discussion, on the motion of Mr. Vance, seconded by Mr. Brandon, it was resolved that the matter of preparing and presenting a brief to the Royal Commission be left with the president in consultation with Dean C. R. Young.

Report of Membership Committee—Mr. Hall gave a brief outline of the work of his committee leading up to the submission of the present report to councillors and branches. Replies were still being received, and he had not yet been able to discuss them with his committee, so that he was unable to give a complete report at this meeting. If any members had any questions that they wished to ask he would be glad to answer them, based on the information in his possession.

Mr. Sills stated that although now a member of the Membership Committee he did not agree with all recommendations of the report as now submitted. The original memorandum on which the Membership Committee's report was based had been prepared by the Peterborough Branch. The branch had now sent a copy of its original memorandum and a further report to all members of Council and to all branches.

Mr. Hall inquired as to whether his committee's final report should be based on the majority opinions received from councillors and branches or on the opinion of the Membership Committee itself. Council did not declare itself on this point, and suggested that Mr. Hall's committee should continue to receive reports from councillors and branches up to the end of June, at which time he could proceed to prepare a final report to Council.

Committee on the Engineer in the Civil Service—The general secretary presented a copy of a letter which had been written by Past-President Beaubien to the Prime Minister, asking for his support in bettering the lot of the engineers in the Civil Service. He also presented a copy of a letter which, by direction of Council, had been sent by the president to the Hon. Mr. Ilsley, urging an upward revision of the salaries paid to engineers in the government service. (These letters appear elsewhere in this issue.)

Committee on Employment Conditions—The general secretary stated that he had no further report from the committee on Employment Conditions. This matter had been discussed earlier in the meeting, when a resolution accepting the committee's various progress reports had been passed.

For the information of Council he reported that the committee of fourteen was meeting in Ottawa on June 12th, at which time the Institute would be represented, although Mr. Heartz, the chairman of the committee, would not be able to attend as he was in the west.

Canadian Radio Technical Planning Board—The general secretary presented two letters from the secretary-treasurer of the Canadian Radio Technical Planning Board, the first enquiring as to the kind of membership the Institute desires to have. The Institute would be permitted representation on all panels and committees, with full participation in the work. The second letter suggested that it might assist the Institute in coming to a decision if one of the officers of the Board were to address the Institute and outline the functions and activities of the C.R.T.P.B.

Mr. Peachey outlined briefly the setup of this Board, and explained that a similar Board existed in the United States. He was of the opinion that eventually the two boards would have to get together. He thought also that the Institute should support this undertaking. He thought it would be quite a stimulus to the members in the Institute who take an active interest in the subject. Following some discussion, Mr. Peachey undertook to investigate the form and degree of the Institute's participation and, after consultation with Mr. Gage, to make a report to Council.

New Branch at Sarnia, Ontario—The general secretary presented a letter from Mr. G. G. Henderson, the councillor for the Border Cities branch, with which had been forwarded an application for the establishment of a new branch of the Institute at Sarnia, Ontario, signed by thirteen Members, five Juniors and three Students of the Institute. The letter explained the difficulties which the Sarnia members had experienced in attending meetings of the Border Cities branch, the headquarters of which was 105 miles from Sarnia. In recent years, wartime restrictions had made it almost impossible for the Sarnia members to attend the meetings of the branch. During the past two or three years, a large number of engineers had moved into the Sarnia district, and a recent survey made by Institute members indicated that the present membership of twenty-five members of all classes could very readily be increased to at least fifty or sixty.

The matter has been discussed with the officers of the Border Cities branch who quite agreed that the Sarnia members should have a branch of their own. While the branch would regret losing the Sarnia group, they felt that Council would be fully justified in establishing a branch there.

On the motion of Mr. Vance, seconded by Mr. Brandon, it was unanimously resolved that the application be accepted and that the necessary steps be taken to establish the boundary line of the new branch area.

Vote of Thanks to Hamilton Branch—On the motion of Mr. Brandon, seconded by Mr. Eadie, it was unanimously resolved that a hearty vote of thanks be extended to the officers and members of the Hamilton branch for their hospitality and for the splendid arrangements which had been made for the holding of this regional meeting of Council. The thanks of Council were also extended to the officers of the Hamilton Golf and Country Club for the facilities which they had made available and which had added so much to the success and pleasure of the meeting.

Date of Next Council Meeting—It was suggested that unless some urgent business requiring immediate attention developed, it would not be necessary to hold a meeting in July, and it was agreed that it be left with the president and the general secretary to decide on the date of the next meeting.

The Council rose at five twenty p.m.

ELECTIONS AND TRANSFERS

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

Members

Caldwell, George Alexander, B.Sc. (Eng.), (Univ. of Glasgow), exchange plant engr., Bell Telephone Co. of Can., Toronto, Ont.
Crothers, Donald Coverdale, B.Sc. (Mech.), (Queen's Univ.), mgr., compressor divn., Canadian Ingersoll-Rand Co., Ltd., Montreal, Que.
Gnaedinger, John Burgess, B.Eng. (Mining), (McGill Univ.), asst. mining engr., Aluminum Co. of Can., Ltd., Montreal, Que.
Jopp, James Melville, B.Sc. (Elec.), (Univ. of Wis.), engr., Abitibi Power & Paper Company, Sault Ste. Marie, Ont.
Morton, Kenneth William, (Univ. Coll., Dundee), district engr., Public Works, Yukon District, New Westminster, B. C.
Taylor, Newton Philip, (Mech. Engr.), (Rensselaer Poly. Inst.), asst. chief engr., Aluminum Co. of Can., Ltd., Montreal, Que.

Juniors

Archibald, John Alexander, Elect. Sub. Lieut., R.C.N.V.R., (N. S. Tech. Coll.), 4 Kirk Street, Peterboro, Ont.
Brockhouse, Bertram Neville, Elect. Sub. Lieut., R.C.N.V.R., (N. S. Tech. Coll.), 4239 Slocan St., Vancouver, B. C.
Franklin, Raymond William, F/O., R.C.A.F., B.Sc. (Civil), (Univ. of Man.), 465 Telfer St., Winnipeg, Man.
Howie, Ross Ellison, B.Eng. (Mech.), (McGill Univ.), Pike River, Que.

Transferred from the class of Junior to that of Members

McGinnis, Arthur David, W/C., R.C.A.F., B.Sc., (Queen's Univ.), M.C.E., (Cornell), King St., W., Kingston, Ont.

Transferred from the class of Student to that of Member

Griffiths, George Henry R., B.Sc., (Civil), (Univ. of Man.), M.Eng. (Civil), (McGill Univ.), Head, constrn. divn., L'Air Liquide Society, Montreal, Que.
Simpson, Charles Cecil, B.Sc., (Elect.), (Univ. of Alta.), on loan to Wartime Shipbuilding Ltd., Montreal, Que.
Vaughan, Robert Polk, S/L., R.C.A.F., B.Eng. (Mech.), (McGill Univ.), engr. officer, No. 1 Air Command, Trenton, Ont.

Transferred from the class of Student to that of Junior

Archibald, Huestis Everett, B.A.Sc. (Civil), (Univ. of Tor.), asst. engr., Dept. of Planning & Development, Queen's Park, Toronto, Ont.
Grimble, Louis George, R.N.F.A.R., B.Sc. (Civil), (Univ. of Alta.), (under training), St. Eugene, Ont.
Hastey, William Kingsley Wright, F/L., R.C.A.F., Repair Squadron & Chief Tech. Engr., 421 Edgewood Ave., Ottawa, Ont.
Levasseur, Jos. Adrian Maurice, (passed Institute's exam. under Schedule "B"), jr. engr., Elect. Engrg. Dept., Sorel Industries Ltd., Sorel, Que.
Smith, Allen Cedric, B.Sc. (Civil), (Univ. of Alta.), chief engr., railway divn., Fred Mannix Co., Ltd., Calgary, Alta.
Stollery, Charles Alex., B.Sc. (Civil), (Univ. of Alta.), A/Lieut. Cdr. SB (E), R.C.N.V.R., Asst. Mgr., Constructive Dept., H.M.C. Dockyard, Halifax, N. S.

Students Admitted

Coates, Donald Francis, (McGill Univ.), 4501 Decarie Blvd., Montreal 28, Que.
Cooper, Sydney Charles, (Univ. of Tor.), 14 Borden St., Toronto, Ont.
Graves, Arthur Herbert, (McGill Univ.), 167 Hopewell Ave., Ottawa, Ont.
Moir, Donald Arthur, (N. S. Tech. Coll.), 12 Jamieson St., Dartmouth, N. S.
Notley, William James, (Univ. of Man.), 96 Evanson St., Winnipeg, Man.
Stapleton, Michael J., (N. S. Tech. Coll.), Barriefield, Ont.

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

Member

Sparrow, Charles William, B.Sc. (Elec.), (Univ. of Man.), transmission & equip. engr., Government of Saskatchewan, Regina, Sask.

Student

Robertson, Wallace William, (Univ. of Sask.), 1020 Aird Ave., Saskatoon, Sask.

QUEBEC

Members

Davison, John Laurence, B.Sc., (N. S. Tech. Coll.), Chief engr., Canadian Comstock Co., Ltd., Montreal, Que.
Gersovitz, Benjamin, B.Sc. & B.Eng., (McGill Univ.), concrete designer and detailer, Truscon Steel Co. of Can., Montreal, Que.
Lamarche, J. J. Emile, B.A.Sc., C.E., (Ecole Poly.), dftsman, foundry divn., Canadian Car & Foundry, Montreal, Que.
Leduc, Albert, Lt. Col., BA.Sc., C.E., E.E., (Ecole Poly.) General Staff Officer, N. D. H. Q., Ottawa, Ont.
Whittall, Fred R., B.Sc., (McGill Univ.), consultg. engr., 21 Shorncliffe Ave., Westmount, Que.

Transferred from the class of Junior to Member

Rose, Paul-Emile, B.A.Sc., C.E. (Ecole Poly.), apparatus engr., Canadian Gen. Elec. Co., Ltd., Montreal, Que.

Transferred from the class of Student to Member

Webster, John Alexander, Captain, B.Eng., (McGill Univ.), asst. to officer i/c measurements & tests divn., Can. Signals Research & Development Establishment, Ottawa, Ont.

THE ENGINEERING INSTITUTE OF CANADA PRIZE AWARDS 1945

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 1945:

Nova Scotia Technical College	John William Powers, S.E.I.C.
University of New Brunswick	Ottis Irvine Logue, S.E.I.C.
Laval University	Pierre Grenier, S.E.I.C.
McGill University	Edward Hoskin
Ecole Polytechnique	Leo Scharry, S.E.I.C.
Queen's University	J. E. Hood
University of Toronto	Norman Reid Buchanan
University of Manitoba	Douglas Garvin Maxwell, S.E.I.C.
University of Saskatchewan	Donald Bentley Smith
University of Alberta	George William Mathers
University of British Columbia	Tom Foster Scott
Royal Military College of Canada	No award, regular course discontinued during the war.

RECENT GRADUATES IN ENGINEERING

Congratulations are in order to the following Juniors and Students of the Institute who have completed their courses at the various Universities:

McGILL UNIVERSITY

HONOURS, MEDALS AND PRIZE AWARDS

Cooper, Glenn Alan, Winnipeg, Man., B.Eng. (Mech.); Honours in Mechanical Engineering.
Knight, Curtis Lawrence Urban, St. Georges, Grenada, B.W.I., B.Eng. (Ci.); University Scholar; British Association Medal; Honours in Civil Engineering; The Robert Forsyth Prize in Theory of Structures and Strength of Materials.
Landauer, Fred Joachim, Montreal, B.Eng. (Mech.); Honours in Mechanical Engineering.
Morgan, George W., Outremont, Que., B.Eng. (Mech.); University Scholar; British Association Medal; Honours in Mechanical Engineering.

DEGREE OF BACHELOR OF ENGINEERING

Barron, John Leonard, St. John's, Nfld. (Chem.).
Bilodeau, Francis James Donald, Westmount. (Mech.).
Bregman, Asher, Montreal. (El.).
Chinn, Norman William, Montreal. (El.).
Crowther, Edward James, Winnipeg, Man. (Mech.).
Dawson, William Frank, Winnipeg, Man. (Mech.).
Décarie, Maurice, Montreal. (Ci.).
Dickie, Edwin James, Stewiacke, N.S. (Mech.).
Epstein, Norman, Outremont. (Chem.).
Farmer, Alan Taylor, Ste. Anne de Bellevue, Que. (El.).
Flemming, William Dunlap, Truro, N.S. (Mech.).
Galbraith, George Harshaw, Bowness, Alta. (Mech.).
Goodwin, Martin Jerome, Outremont. (Ci.).
Hashim, Robert, Montreal. (Mech.).
Heuser, Eric Richard, Montreal. (Chem.).
Lee, William Ulysses, Montreal. (Mech.).
Lion, Edgar, Montreal. (Ci.).
MacEachern, Clinton Whitman, Stellarton, N.S. (Chem.).
Mann, Stanley Lawton Wingate, Calgary, Alta. (Chem.).
Milot, Raymond, Saint Paulin, Que. (El.).
Park, John Kenneth, Lachine, Que. (Ci.).
Petruchick, John Charton, Montreal. (Mech.).
Pichette, Joseph Paul Jacques, Grand'Mere, Que. (Mech.).
Weintraub, Joseph Mordecai, Montreal. (Mech.).
Wilk, Martin Bradbury, Montreal. (Chem.).
Wyeth, Eric Alfred, Winnipeg, Man. (Mech.).
Yuile, Arthur McLeod, Como, Que. (Ci.).

UNIVERSITY OF ALBERTA

HONOURS, MEDALS AND PRIZE AWARDS

Bernard, Gerald William, Edmonton, Alta., B.Sc. (Ci.) with distinction.
Brandley, Reinard W., Stirling, Alta., B.Sc. (Ci.) with distinction.
Enarson, Otto Ernest, Wetaskiwin, Alta., B.Sc. (Ci.) with distinction.
Fead, John William Norman, Edmonton, Alta., B.Sc. (Ci.) with distinction.
Ferguson, David Allan, Saskatoon, Sask., B.Sc. (Ci.) with distinction.
Longworth, Jack, Bellevue, Alta., B.Sc. (Ci.) with distinction; The H. R. Webb Memorial Prize in Civil Engineering offered by the Association of Professional Engineers of Alberta.
McDougall, Roderick Lorne, Edmonton, Alta., B.Sc. (Chem.) with distinction; The H. R. Webb Memorial Prize in Chemical Engineering offered by the Association of Professional Engineers of Alberta.
Roshko, Anatol, Edmonton, Alta., B.Sc. (Engrg. Physics) with high distinction; The Henry Birks & Sons Gold Medal.
Walker, Lloyd Arthur, Masenod, Sask., B.Sc. (Ci.) with distinction.

DEGREE OF BACHELOR OF SCIENCE

Asselstine, Stanley Howard, Edmonton, Alta. (Chem.).
Gregory, John, Edmonton, Alta. (Chem.).
Hutton, George Alexander, Bellevue, Alta. (Ci.).
Jackson, William Burley, Edmonton, Alta. (Ci.).
Jones, Owen James, Coleman, Alta. (Ci.).
Nelson, Leslie William, Edmonton, Alta. (Ci.).
Nicholls, John Henry, Murrayville, B.C. (Chem.).

UNIVERSITY OF MANITOBA

HONOURS AND PRIZES

Kato, Yoichi, Winnipeg, Man., B.Sc. (Elec.); Honours in Electrical Engineering; the Engineering Graduation Thesis Prize of the Manitoba Power Commission.
Seline, Walter George, Point du Bois, Man., B.Sc. (Elec.); Honours in Electrical Engineering; the Engineering Graduation Thesis Prize of the Manitoba Power Commission.
Wood, Eric Oren, Fort Frances, Ont., B.Sc. (Ci.); Honours in Civil Engineering; the William M. Berry Prize in Civil Engineering.

DEGREE OF BACHELOR OF SCIENCE

Abells, Herbert Benjamin, Winnipeg, Man. (Elec.).
Bamford, Alfred Basil, Winnipeg, Man. (Elec.).
Billinkoff, Louis, Winnipeg, Man. (Elec.).
Dixon, Francis Fox, Hamilton, Ont. (Elec.).
Guard, Donald Edward, Winnipeg, Man. (Ci.).
Hovey, Charles Mansur, Winnipeg, Man. (Ci.).
Ostevik, Sigurd Torleif, Richlea, Sask. (Elec.).
Page, John Edward, Winnipeg, Man. (Ci.).
Phillips, Herbert Frederick, St. Vital, Man. (Ci.).
Shabaga, William, Winnipeg, Man. (Elec.).
Weber, Thomas Eugene, Portage la Prairie, Man. (Ci.).
Zaharuk, Peter, Yorkton, Sask. (Elec.).

UNIVERSITY OF BRITISH COLUMBIA

HONOURS

Bunnell, Frank R., Vancouver, B.C., B.A.Sc. (Ci.); Honours in Civil Engineering.

DEGREE OF BACHELOR OF APPLIED SCIENCE

Anderson, John Douglas, Vancouver, B.C. (Ci.).
Binnie, Robert Frederick, Vancouver, B.C. (Ci.).
Calderhead, Gordon Arthur, Vancouver, B.C. (Ci.).
Confortin, John Camille, Vancouver, B.C. (Ci.).
Dennison, James Alexander, Vancouver, B.C. (Ci.).
Eyre, Alan M., Vancouver, B.C. (Ci.).
Fraser, Donald Arthur, Nelson, B.C. (Ci.).
Graves, Harold Bradstock Robertson, Vancouver, B.C. (Ci.).
Grimble, Wilf George, Vancouver, B.C. (Ci.).
Hole, Frederick R., Vancouver, B.C. (Ci.).
Kent, Joseph Chan, Vancouver, B.C. (Ci.).
Ker, Walter Allan, Vancouver, B.C. (Ci.).
Lefeaux, Stuart Stanley, West Vancouver, B.C. (Ci.).
Scott, William Bruce, Vancouver, B.C. (Ci.).
Turley, Francis Edward, Vancouver, B.C. (Ci.).
Sydney Oscar Wigen, Vancouver, B.C. (Ci.).

NOVA SCOTIA TECHNICAL COLLEGE

MEDAL

Fielding, George Parker, Dartmouth, N.S., B.Eng. (Ci.); The Governor General's Medal.

DEGREE OF BACHELOR OF ENGINEERING

Bennett, Graham Alward, New Glasgow, N.S. (Mech.).
Bishop, Keith Clement, Halifax, N.S. (Ci.).
Burris, Donald Archibald, Upper Musquodoboit, N.S. (Mech.).
Eisenhauer, Daniel Andrew, Lunenburg, N.S. (Mech.).
Garland, Hedley Robert, St. John's, Nfld. (Ci.).
Graham, Verne Allister, Halifax, N.S. (Mech.).
Harris, William Frederick, Halifax, N.S. (El.).
MacKay, Donald Akerley, Petite Riviere, N.S. (Ci.).
McLean, Donald Fraser, Toronto, Ont. (El.).
Mader, Gordon Douglas, Halifax, N.S. (Ci.).
Stapleton, Michael Joseph, Harbour Grace, Nfld. (El.).
Stevenson, David Alexander, St. John's, Nfld. (Ci.).
Tuff, Edmund Charles Moores, St. John's, Nfld. (El.).
Trudeau, Guy Gustave Joseph, Halifax, N.S. (Mi.).
Vaughan, Joseph Philip James, Halifax, N.S. (Ci.).
Woolfrey, George Raymond, Carmanville, Nfld.

UNIVERSITY OF SASKATCHEWAN

WITH DISTINCTION

Graham, Harry Marker, Plato, Sask., B.Sc. (Mech.); Great distinction in engineering.

DEGREE OF BACHELOR OF SCIENCE

Anderson, Cecil George, Vancouver, B.C. (Mech.).
Birbrager, Jake, Bienfait, Sask. (Mech.).
Babey, William Joseph, St. Philips, Sask. (Ceramic).
Blezard, Roy John, Kimberley, B.C. (Mech.).
Boyle, William Eric, Pense, Sask. (Mech.).

Brandlmayr, Saskatoon, Sask. (Mech.).
Brooks, Eyrle Elwood, Cheviot, Sask (Mech.).
Carbert, John Mervyn, Melfort, Sask. (Mech.).
Ewing, Harlan Thomas, Saskatoon, Sask. (Mech.).
Francis, Joseph Albert, Climax, Sask. (Mech.).
Hamilton, Geoffrey Craig, Mazenod, Sask. (Ci.).
Holmes, Loyde Thomas, Regina, Sask. (Ci.).
Horner, William James, Blaine Lake, Sask. (Mech.).
Hudd, Bruce Murdock, Melfort, Sask. (Mech.).
Iverson, Norman Leif, Saskatoon, Sask. (Ci.).
Larmour, Donald Arthur, Lanigan, Sask. (Ci.).
Mollard, John Douglas, Watrous, Sask. (Ci.).
Mowchenko, Alexander, Ardill, Sask. (Mech.).
Munro, Donald David, Saskatoon, Sask. (Mech.).
Nixon, Edward Everett, Moose Jaw, Sask. (Ci.).
Ottem, Ray Willard, Unity, Sask. (Ci.).
Payton, Richard Neil, Saskatoon, Sask. (Mech.).
Rowbotham, Brian Howard, Stranraer, Sask. (Mech.).
Sargent, Kenneth Stanley, Moose Jaw, Sask. (Ceramic).
Smith, Thomas Rutherford, Pathlow, Sask. (Mech.).
Spencer, Henry Anderson, Saskatoon, Sask. (Mech.).
Tite, Allan Wilfred Stanley, Regina, Sask. (Mech.).

UNIVERSITY OF TORONTO

HONOURS

Becks, Douglas Edwin, Toronto, Ont., B.A.Sc. (Mech.)
Cavanagh, Robert Terence, Toronto, Ont., B.A.Sc. (El.).
MacDonald, Donald Hugh, Oshawa, Ont., B.A.Sc. (Ci.).

DEGREE OF BACHELOR OF APPLIED SCIENCE

Cooper, Sydney Charles, Toronto, Ont., B.A.Sc. (Ci.).
Davidson, Gordon Petrie, Toronto, Ont., B.A.Sc. (Ci.).
Gordon, Lynn Marshal, Kamloops, B.C., B.A.Sc. (El.).
Horton, Graydon Thring, Toronto, Ont., B.A.Sc. (Ci.).
James, Lourimer Abner, Moncton, N.B., B.A.Sc. (Mech.).
Kenney, Ben Doran, Toronto, Ont., B.A.Sc. (El.).
Legris, Joseph Antoine, Toronto, Ont., B.A.Sc. (Mech.).
Peacock, Edward Massie, Toronto, Ont., B.A.Sc. (Mech.).
Venton, Donald Maxwell, Alymer, Ont., B.A.Sc. (Ci.).

QUEEN'S UNIVERSITY

HONOURS, MEDALS, SCHOLARSHIPS AND PRIZES

Bader, Alfred Robert, Westmount, Que., B.Sc. (Chemistry); Honours in Chemistry; Departmental Medal in Chemistry; Andrina McCulloch Scholarship in Public Speaking.
Gramoli, Louizio, Cobalt, Ont., B.Sc. (El.); Honours in Electrical Engineering.
Harvey, John Arthur, Saskatoon, Sask., B.Sc. (Physics); Honours in Engineering Physics; The Governor-General's Medal; Departmental Medal in Engineering Physics.
Lee, Frank Bing-Siu, Ottawa, Ont., B.Sc. (El.); Honours in Electrical Engineering; Andrina McCulloch Scholarship in Public Speaking.
Moore, Arthur Donald, Estevan, Sask., B.Sc. (El.); Honours in Electrical Engineering; Departmental Medal in Electrical Engineering; National Research Council Bursarie.
Secord, Lloyd Calvin, Leamington, Ont., B.Sc. (Mech.); Honours in Mechanical Engineering; Departmental Medal in Mechanical Engineering.
Stewart, Robert William, Calgary, Alta., B.Sc. (Physics); Honours in Engineering Physics; Reuben Wells Leonard Resident Fellowship of $500.
Van Patter, Douglas Macpherson, Westmount, Que., B.Sc. (Physics); Honours in Engineering Physics.

DEGREE OF BACHELOR OF SCIENCE

Adams, Garnet David, Belleville, Ont. (Mech.).
Alexander, Samuel James Franklin, Kingston, Ont. (Mech.).
Bauman, Desmond A., Buckingham, Que. (Mech.).
Beamish, Vincent Augustine, Merrickville, Ont. (Elec.).
Beckett, Donald Russell, Fort William, Ont. (Ci.).
Bennett, James Metcalfe, Campbellford, Ont. (Mech.).
Birks, William Robert, Brockville, Ont. (Mech.).
Brison, Robert Joshua, Falconbridge, Ont. (Met.).
Browning, Douglas R. S., Cardinal, Ont. (Mech.).
Campbell, Donald Ross, Kingston, Ont. (Mech.).
Carthew, Charles William I., Windsor, Ont. (Ci.).
Charlesworth, Edward Frank, Ottawa, Ont. (Chem.).
Craig, Donald Spence, Ridgetown, Ont. (Physics).
Creed, Frank Cyprian, Walkerville, Ont. (El.).
Davis, Merritt M., Greenview, Ont. (Ci.).
Elliott, S. H. Mackenzie, Port Hope, Ont. (Mech.).
Fenton, Stuart William Cameron, Ottawa, Ont. (Chemistry).
Geddes, Walter Robert, Calabogie, Ont. (Mech.).
Gordon, James Keith, Ottawa, Ont. (Ci.).
Hanna, John Newton, Brockville, Ont. (Mech.).
Hope, Robert Leslie, Hamilton, Ont. (Mech.).
Horricks, John Robert, Pembroke, Ont. (Mech.).
Hyde, Ernest Charles Garrow, Toronto, Ont. (Chem.).
Jarvis, James Gordon, Aultsville, Ont. (Physics).
Johnson, Ivar Conrad, Cochrane, Ont. (Mech.).
Lamont, Donald Alexander, Morrisburg, Ont. (El.).
Lea, Edgar Robert, Almonte, Ont. (Mech.).
Leon, Clifford E., Toronto, Ont. (Mech.).
Maguire, Robert Adam, Kingston, Ont. (Met.).
Meredith, William Ralph, Kingston, Ont. (Mech.).
Moro, Sylvano Bruno, Timmins, Ont. (Mech.).
Nash, Philip Townsend, Hamilton, Ont. (Mech.).
Nelson, Ernest William, Port Arthur, Ont. (Ci.).
Ness, Arthur Franklin, Port Dalhousie, Ont. (Mech.).
Oattes, Merle Ebert, Carleton Place, Ont. (El.).
Randall, Norman, Ottawa, Ont. (El.).
Richardson, Kenneth Grant, Woodroffe, Ont. (El.).
Roberts, William Raymond, Kitchener, Ont. (El.).
Scott, James Blair, Blenheim, Ont. (Mech.).
Sheffield, Harvey C., Lyndhurst, Ont. (El.).
Sinclair, Donald Alfred, St. Thomas, Ont. (Ci.).
Slone, Morton Rueven, Ottawa, Ont. (Mech.).
Stevenson, William Herbert, London, Ont. (Chem.).
Tompkins, Charles C., Brighton, Ont. (Mech.).
Trewartha, Frank Everett, Clinton, Ont. (Mech.).
Walter, Herman Karl, Toronto, Ont. (Mech.).
Wilson, Hugh William, Alvinston, Ont. (Physics).
Wilson, William James Fielding, Ottawa, Ont. (El.).
Woolsey, Edgar Garnet, Ottawa, Ont. (Ci.).
Zabek, Valerian John, Lachine, Que. (Met.).

THE UNIVERSITY OF NEW BRUNSWICK

PRIZE

Ward, Frank Lindsay, Fredericton, N.B., B.Sc. (El.); The Brydone-Jack Prize for highest standing in fourth year Electrical Engineering.

DEGREE OF BACHELOR OF SCIENCE

Adams, Gerald Clifton, Fredericton, N.B. (Ci.).
Ayers, Ralph Elwin, Fredericton, N.B. (El.).
Davidson, Frederick William, Petitcodiac, N.B. (El.).
Evans, Robert Edward, Fredericton, N.B. (El.).
Gerrish, Arnold Henry, Fredericton, N.B. (El.).
Gillies, James Robert, Saint John, N.B. (El.).
Green, Donald Hughes, Fredericton, N.B. (El.).
Harrison, John Austen, Fredericton, N.B. (El.).
Lewis, Aubrey Allison, Petitcodiac, N.B. (El.)
Mallory, Richard Frederick, Woodstock, N.B. (Ci.).
Mulherin, James Kenneth Conrad, Fredericton, N.B. (Ci.).
MacDougall, Clarence Donald, Fredericton, N.B. (El.).
MacKenzie, James MacRae, Regina, Sask. (Ci.).
MacKenzie, Roderick Fraser, Fredericton, N.B. (Ci.).
Plummer, David Kent, Saint John, N.B. (El.).
Reid, Edwin Charles, Norton, N.B. (El.).
Ritchie, Wendell Philip Jones, Fredericton, N.B. (Ci.).
Robinson, Paul Gordon, Fredericton, N.B. (Ci.).

LAVAL UNIVERSITY, QUÉBEC

DEGRÉ DE BACHELIER ÈS SCIENCES APPLIQUÉES

D'Amours, Maurice, Quebec, Que. (El.).
Lavallée, Paul, St. Andrews East, Que. (El.).
Painchaud, Robert, Beauport, Que. (El.).
Pouliot, Jean, Beauport, Que. (El.).
Tremblay, Jules, Quebec, Que. (El.).

ÉCOLE POLYTECHNIQUE

DISTINCTIONS ET PRIX

Saint-Martin, Maurice, B.Sc.A. (mécanique-électricité), I.C., avec grande distinction. Médaille d'argent de l'Association des Diplômés de Polytechnique.
Gendron, Lucien, B.Sc.A. (chimie industrielle), I.C., avec distinction.
Gargas, John, B.Sc.A. (mécanique-électricité), I.C., avec distinction.
Noiseux, Denis, B.Sc.A. (mécanique-électricité), I.C. Médaille de Bronze de l'Association des Diplômés de Polytechnique.
Asselin, Louis-André, B.Sc.A. (mécanique-électricité), I.C. Médaille d'Or de l'Association des Diplômés de Polytechnique.
Nobert, Jean-Baptiste, B.Sc.A. (chimie industrielle), I.C. Prix de la 50ème promotion de l'Ecole Polytechnique.
Duhamel, Julien, B.Sc.A.(travaux publics-bâtiments), I.C. Prix Ernest Cormier.

DEGRÉ DE BACHELIER ÈS SCIENCES APPLIQUÉES ET DIPLÔME D'INGÉNIEUR CIVIL

Laviolette, Jean-Paul, (mécanique-électricité).
Turcotte, Léo, (mécanique-électricité).
Bouthillier, Jean, (mécanique-électricité).
Troalen, Pierre, (mécanique-électricité).
Pauzé, Jean, (mécanique-électricité).
Lecavalier, Robert, (aéronautique).
Trottier, Alfred, (travaux publics-bâtiments).
Derome, Louis-P. (mécanique-électricité).
Thomas, Georges E. (travaux publics-bâtiments).
Morin, Joseph-Henri, (mécanique-électricité).
Marier, Jean, (mécanique-électricité).
Ménard, Robert, (mécanique-électricité).
Bédard, Jacques, (mécanique-électricité).
Matte, Paul, (travaux publics-bâtiments).
Dansereau, Gérard, (travaux publics-bâtiments).
Yespelkis, Charles R. (travaux publics-bâtiments).
Bellefeuille, Marcel, (mécanique-électricité).
Pruneau, Amédée, (travaux publics-bâtiments).
Catafard, Rémi, (mécanique-électricité).
Delisle, Maurice, (mécanique-électricité).
O'Bomsawin, Jos-Gérard, (chimie industrielle).
Thibault, Sylvain, (mécanique-électricité).
Saint-Pierre, Robert, (mécanique-électricité).
Deniger, Jean, (mines-métallurgie).
Petitpas, Marcel, (mécanique-électricité).
Ouimet, Pierre, (aéronautique).
Laviolette, Jean-Guy, (travaux publics-bâtiments).
Charest, René, (travaux publics-bâtiments).
Grenier, François, (aéronautique).
Fortin, Bernard, (mécanique-électricité).
Gingras, Roch-Henri, (mécanique-électricité).
Gravel, Chs.-Edouard, (travaux publics-bâtiments).
Chevrette, Bruno, (travaux publics-bâtiments).

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*.


J. Omer Martineau, M.E.I.C.

J. Omer Martineau, M.E.I.C., has been elected chairman of the Quebec Branch of the Institute. Born at Charlesbourg, Que., he graduated from Queen's University with the degree of B.Sc. in 1915. He is assistant chief engineer, Department of Highways, Province of Quebec, at Quebec, Que., which position he has held since 1922. Mr. Martineau joined the Institute as a Member in 1935.

Lieutenant-Colonel Cecil R. McCort, M.E.I.C., has been promoted to his present rank and has received the appointment of Assistant Quartermaster General at National Defence Headquarters, Ottawa. Colonel McCort had been overseas since April 1941.

A. F. G. Cadenhead, M.E.I.C., retiring president of the interim council of Chemical Institute of Canada, was granted an honorary degree of doctor of science by Laval University, on the occasion of the Annual Conference of the Institute, held in Quebec last month. Dr. Cadenhead is the director of the department of chemical development, Shawinigan Chemicals Limited, at Shawinigan Falls, Que.

Wing Commander C. W. Crossland, M.E.I.C., has been transferred from No. 1 Air Command Headquarters, Trenton, Ont., to Air Force Headquarters, Ottawa. He has been appointed liaison officer to the Royal Commission on Veterans' Qualifications.

E. M. Little, M.E.I.C., general manager of Anglo-Canadian Pulp and Paper Mills Limited, has been appointed president of the board of directors. He has also been made president of the board of Gaspesia Sulphite Company Limited.

News of the Personal Activities of members of the Institute

Dr. R. C. Wallace, C.M.G., HON. M.E.I.C., principal and vice-chancellor of Queen's University, Kingston, Ont., was presented with the degree of doctor of civil law, honoris causa, by Bishop's University, Lennoxville, Que., at its recent centennial anniversary.

A. G. Dalzell, M.E.I.C., has resigned his position as traffic engineer in the city planning department of the City of Toronto. Mr. Dalzell is residing at 58 Sherwood Avenue, Toronto 12, Ont.

Maurice Bélanger, M.E.I.C., is now with the Department of Public Works of the City of Montreal. He was formerly on the staff of Sorel Industries Limited at Sorel, Que.

E. O. Greening, M.E.I.C., who has been serving with the 7th Canadian Construction Coy., R.C.E., Canadian Army Overseas, recently returned to Canada and has retired from the Army.

T. S. Moffat, M.E.I.C., is now associated with the New Brunswick Resources Development Board as forest products development engineer at Saint John, N.B. He was previously employed as superintendent with Provincial Wood Products Company, Saint John.

J. M. M. Lamb, M.E.I.C. is the newly elected chairman of the Saint John Branch of the Institute. Mr. Lamb holds the position of agent of the Department of Transport at Saint John, N.B. He joined the Department of Public Works as assistant engineer in 1913 and has been in the service of the Dominion government since that time. He was promoted to his present position in 1942, having been employed as district engineer for the two years prior to that time.

Mr. Lamb joined the Institute as a Member in 1942.


J. M. M. Lamb, M.E.I.C.

F. R. Burfield, M.E.I.C.

F. R. Burfield, M.E.I.C., is the newly elected chairman of the Edmonton Branch of the Institute. Born in Warlingham, Eng., he received his education in England. In 1913 he became employed with the Department of Interior, Irrigation Office, at Calgary, Alta. From 1916 until 1919 he served with the Allied Armies and, on demobilization, returned to his former position with the Dominion government where he remained until 1930. For the eight years following he worked as inspecting engineer with the Water Resources Office, Province of Alberta, Edmonton, and in 1938 became chief engineer and acting director which position he holds at the present time.

Mr. Burfield joined the Institute as a Member in 1916. He served as secretary-treasurer of the Edmonton Branch from 1941 until 1944.

Jean C. Béique, M.E.I.C., is at present employed as city manager of the City of Grand'Mère, Que.

H. M. Rowe, M.E.I.C., formerly superintendent of charging, Stormont Chemicals Limited, Cornwall, Ont., is now with the Veterans Affairs Department at Ottawa, Ont.

W. O. Maclaren, M.E.I.C., has resigned his position with the Ministry of Works, England, and is now associated with the firm of Brian Colquhoun and Partners, consulting engineers, with head office in London, Eng.

M. L. Walker, M.E.I.C., is now employed by Imperial Oil Limited at Sarnia, Ont. He enlisted in the R.C.A.F., Aeronautical Engineering Branch, in 1940, with the rank of flying officer. During his term of service he acted as assistant to the chief inspector of engines at Air Force headquarters, Ottawa, and later was transferred to the Works and Buildings Branch with the rank of flight lieutenant. In 1942 he was posted to Eastern Air Command Headquarters, Halifax, in charge of heating and ventilation, gasoline storage and railway sidings at all stations in the maritimes. In the following year he was posted to Headquarters in Ottawa in charge of heating design. In 1943, following completion of design in connection with the major building programme of the R.C.A.F., he resigned his commission and returned to his civilian position in the engineering department of Imperial Oil Limited.

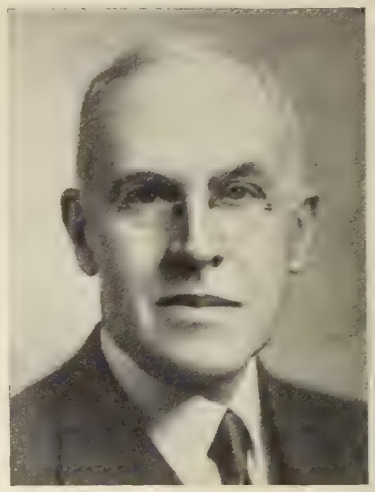
A. K. Grimmer, M.E.I.C., has recently completed 25 years' service as town manager of Temiskaming, Que. The occasion was fittingly recognized by a presentation to Mr. Grimmer, who is also mayor of the town.

Franklin G. Smoke, S.E.I.C., is now associated with the Stewart-Warner-Alemite Company of Canada, Belleville, Ont., as a junior engineer working on radio design and specification detail work. He graduated this year from Queen's University.

Paúl V. Palmer, S.E.I.C., a recent graduate of Ecole Polytechnique, Montreal, is now employed by the Manitoba Paper Co. Ltd. at Pine Falls, Man.

Obituaries

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



GEORGE TILLEY SEABURY

1880 - 1945

A leading figure in the movement towards the better organization of the engineering profession in North America was taken from us when George T. Seabury died on May 25th. Actually he was on the point of retiring from the Secretaryship of the American Society of Civil Engineers. For twenty years he had directed the affairs of the senior engineering society of the United States, a body with over twenty thousand members and more than sixty local branches. His duties brought him into intimate contact with leaders in all phases of engineering thought and action, both in the United States and Canada. He leaves behind him an enviable record of achievement as a planner and administrator, and a host of friends who will miss him greatly.

George Seabury was a son of New England, for he was born in Rhode Island. He took his engineering degree in 1902 at the Massachusetts Institute of Technology and at once entered the field of heavy engineering construction. From 1906 to 1915 he took a responsible part in the engineering work of the important developments which were then being made in the water supply of New York City, including the construction of the Ashokan Dam and Reservoir, the Catskill Aqueduct, the Kensico Reservoir and the Kensico Dam.

His success in this work led to his appointment in 1915 as division engineer in charge of the construction of the new water supply for Providence, R.I., a project involving an outlay of some eighteen million dollars. He left this position in 1917 when the United States entered the war, serving in the Quartermaster Department of the U.S. Army with the rank of Major. He was in charge of construction work at seven of the army camps. Following the war he established and headed for four years the contracting firm of George T. Seabury, Inc., specializing in heavy construction; he then became manager of the Providence, R.I., Safety Council.

With this wide experience as a background, he was chosen in January 1925 as the chief executive officer of the American Society of Civil Engineers.

During his secretaryship the Society has greatly widened the field of its activities, has nearly doubled its membership, and has multiplied the services to its members. Local centres have been established throughout the country. Thousands of engineering students have become affiliated with the Society. In 1930 the Society's national professional journal, "Civil Engineering", was added to the list of its well known publications.

But in addition to Mr. Seabury's work for the society of which he was secretary, he gave unstintingly of his time and effort to many activities whose object is the development of professional esprit de corps and the better organization of the engineering profession. For example, he served as vice-president of American Engineering Council, as secretary of the Engineers' Council for Professional Development, as president of the Engineering Societies Personnel Service, Inc., and as secretary of the Committee on the Organization of the Engineering Profession as a Whole: all engineering bodies of national scope.

In George Seabury the officers and members of The Engineering Institute of Canada have lost a valued adviser and friend. This is especially the case with those past presidents and general secretaries of the Institute who have served during his tenure of office. For the past twenty years it has been possible to discuss frankly with him the many growing pains which have affected organized engineering in Canada. His breadth of view, his good judgment, his understanding attitude towards all issues in a controversy, his zeal for dignity and public service in the profession, all these have won for him the respect of Canadian engineers.

George Seabury was an honorary member of the national engineering society of Holland, the Koninklijk Instituut van Ingenieurs, and a Member of The Engineering Institute of Canada. He will be greatly missed at our Annual Meetings, at which he was a regular attendant and a most welcome guest. Everyone will recall his agreeable personality, the interest he took in our Institute affairs, and the esteem in which he was held by all who met him. As a promoter of good international relations he contributed much to the betterment of understanding between engineers in the United States and Canada.

Outstanding as an organizer and executive, his views were as a rule inclined to conservatism, aiming at a policy of steady development along well-thought-out lines. His methods have been fully justified by the progress of the society to which he has devoted so faithfully the best part of his life.

Walter Reginald Pottle, M.E.I.C., a pioneer of amateur radio in the west, died in Regina, Sask., on May 26th, 1945, following a short illness. Born at Winchester, Eng., on January 12th, 1890, he received his education in England.

On coming to Canada in 1911 he entered the service of the Moose Jaw land titles office from which he enlisted in 1915 as a wireless officer in the R.C.N.V.R. Prior to the war he had designed and operated his own private experimental radio station in Moose Jaw and after demobilization he returned to that city where he worked for some time as radio inspector of the Radio Branch, Department of Marine and Fisheries. He was selected by the Department to take charge of the installation, maintenance and operation of the Field, B.C., amplifying station which was one of the major links on the transcontinental Jubilee broadcast conducted jointly by the Dominion government and the major telephone companies of the western provinces.

In 1927 Mr. Pottle was appointed divisional radio inspector for the Province of Saskatchewan, supervising the work of the other inspectors. Under his supervision the inspection service developed to meet the changing problems and increasing needs arising from the expansion of the radio industry. In 1937 he was made supervising radio inspector of the Radio Division, Department of Transport, which position he held until his death.

Mr. Pottle joined the Institute as an Associate Member in 1938, transferring to Member in 1940.

E. S. M. Lovelace, M.E.I.C.

Edgar Sydney Montgomery Lovelace, M.E.I.C., died suddenly at his home in Montreal on May 16th, 1945. Born at Montreal, Que., on April 3rd, 1866, he graduated with honours and the British Association gold medal in the advanced course of civil engineering from McGill University in 1888.

For the four years after graduation he worked as assistant engineer on the double track construction of the Grand Trunk Railway between Montreal and Toronto. From 1892 until 1901 he was first engaged as a surveyor for the proposed electric railway between St. Louis and Chicago and later was in charge of architectural iron work in Montreal. In 1901 he returned to the Grand Trunk Railway as assistant engineer in charge of surveys and construction of several new lines. He was later connected with the Riordon Pulp Company and the St. Lawrence Pulp and Lumber Company. He worked for some time as a consulting engineer in Montreal and in 1932 became associated with the Beauharnois Light, Heat and Power Company in Montreal. He retired from this position in 1935 and spent the next two years in British Guiana. On his return to Canada he was employed by Fairbanks-Morse Co. Ltd. as a draughtsman on the building of minesweepers at Shelburne, N.S. He remained there until December 1944.

Mr. Lovelace joined the Institute as a Student in December 1887, the year of its foundation as the Canadian Society of Civil Engineers. He transferred to Associate Member in 1893 and to Member in 1906. He was made a Life Member in 1935.

News of the Branches

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

EDMONTON BRANCH

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

The annual meeting of the Branch was held on April 24th, 1945, at which time reports of committees were presented and election of officers for the coming year took place.

A film "From the Ground Up" was shown describing the manufacture of explosives.

HAMILTON BRANCH

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

On Thursday, May 17th, the regular monthly meeting of the Hamilton Branch of the Institute was held at McMaster University; 130 members and guests and their ladies were present. N. Eager, branch chairman presided; A. R. Hannaford, vice-chairman, introduced the speaker of the evening, Mr. Leland L. Merrill.

Mr. Merrill, recently returned from England where he had served since early 1942 as transport officer and engineer to the 1st Division, Canadian Firefighters Corps, spoke on **Action Stations on the Front Line of Britain.**

In introduction, Mr. Merrill paid high tribute to the British people, who with matchless fortitude had withstood for so long the aerial onslaught on the Islands.

The speaker related in detail the sequence of German attacks on the British Isles, showing the development of their strategy from the initial effort to destroy the R.A.F., the bombing of London and the industrial cities to the final concentrated attacks on port cities.

The great attacks on London resulted in very numerous and extensive fires. The speaker revealed astounding figures of the number and magnitude of simultaneous conflagrations with which heroic firefighters had to cope. The difficult and dangerous work of fighting these fires went on despite all hazards, the loss of water and equipment—some 5,500 pieces of equipment being destroyed in 3½ years in London.

Mr. Merrill gave vivid accounts of his personal experiences with robot and rocket bombs. Had the enemy been allowed to develop these new weapons to perfection, civilization might conceivably have been destroyed.

The fantastic holocausts of fire that were fought and subdued by the grimly heroic feats of the firefighters were revealed in the showing of moving pictures of London and port towns under blitz attack.

N. Eager moved a vote of thanks to the speaker.

NIAGARA PENINSULA BRANCH

J. H. Ings, M.E.I.C. - *Secretary-Treasurer*
P. A. Pasquet, Jr.E.I.C. - *Branch News Editor*

The Niagara Peninsula Branch held a dinner meeting in the Leonard Hotel, St. Catharines, on April 26th, with about 40 members in attendance; W. D. Bracken presided.

The speaker of the evening was P. R. Sandwell, development engineer with the Ontario Paper Company. Mr. Sandwell, who was introduced by M. H. Jones, chose as his subject **The Paper Industry in Australia.**

Having recently returned from Australia where he was connected with bringing the Boyer mill into production, the speaker, from his first hand experience, described many notable differences between Canadian and Australian methods of newsprint manufacture.

Mr. Sandwell covered the main geographical features of Australia including Tasmania where is located the first Australian newsprint mill, brought into production as recently as 1941. This mill is owned and operated by Australian Newsprint Mills Pty. Ltd. Australia is essentially a dry country of plains and grasslands with no extensive softwood forests. Tasmania, in comparison, is surprisingly different with a rainfall as much as 160 in. and with dense forests of eucalyptus trees. Although there are about 400 varieties, only a few of these hardwoods are suitable for pulp and paper making. None have been found adaptable to the acid process although some are being used for ground wood and alkaline process pulps. These do not compare as yet with the soft wood pulps and about 20 per cent imported soft wood pulps are being used to supplement the native product in the production of newsprint. The serious problem of drought facing some parts of Australia was also touched upon.

The talk was illustrated by many informative pictures and slides. The varied questions put to the speaker at the close of his paper showed the interest with which it was received.

At the conclusion of the meeting, C. Climo, on behalf of all present, thanked Mr. Sandwell for his excellent paper.

* * *

About 70 members were present to welcome the president of The Engineering Institute of Canada, Dean E. P. Fetherstonhaugh, at the annual dinner meeting of the Branch held on Thursday, June 7th, at the Queen Victoria Park Restaurant, Niagara Falls, Ont.

The retiring chairman, W. D. Bracken, welcomed the members and guests, and introduced the out-of-town members who attended including Col. W. J. Wilson, Alex Love, A. R. Hannaford, Major D. C. MacCallum, Major B. Watson, J. D. Burbank and Dr. L. A. Wright, general secretary.

Mr. Bracken spoke on the necessity of engineers becoming more closely associated in post-war planning and in community planning in particular. The incoming branch chairman, J. H. Ings, was introduced. Mr. Ings, who has been branch secretary-treasurer for several years took the opportunity to thank all who had so ably assisted him in his past duties and wished success to P. A. Pasquet who will fill the position vacated. A. L. MacPhail introduced the new branch executive appointed for the coming year.

C. G. Cline introduced President Fetherstonhaugh who spoke on the education of engineers, stressing the need he thought of further studies in humanities for engineers to enable them to assume even greater responsibilities of citizenship.

At the conclusion of the president's address, Dr. L. A. Wright, general secretary of the Institute, reviewed briefly the headquarters activities for the past year and outlined several plans under discussion by council. He expressed regret that so few engineers were available as consultants to assist the various municipalities in the undertakings being proposed. To improve this situation it has been proposed that a central committee be formed to give assistance. Money to municipalities is readily available for town planning schemes which have been well studied and worked out in detail before submission for approval by government authorities.

Regret was expressed at the death of Mr. George Seabury, president of the American Society of Civil Engineers, known personally to many of the Canadian members.

Major D. C. MacCallum spoke to the members regarding his work in assisting in the rehabilitation of members retiring from the armed forces.

At the close of the meeting A. W. F. McQueen moved a vote of thanks and appreciation to the president and his party.

OTTAWA BRANCH

C. G. Biesenthal, M.E.I.C - *Secretary-Treasurer*
R. C. Purser, M.E.I.C. - - *Branch News Editor*

Engineering problems of the war in Europe and North Africa were described to members of the Ottawa Branch by Major-General H. B. W. Hughes, C.B., D.S.O., O.B.E., at a luncheon held in his honour at the Chateau Laurier on May 24th. The general, engineer-in-chief of the British War Office, formerly engineer-in-chief with the Middle East forces, and then engineer to General Eisenhower in the European battles, painted a vivid picture of the manifold problems facing engineers in wartime.

The recently announced pipe lines beneath the English channel to the continent to carry oil supplies to the Allied forces were described. Several other innovations were outlined such as: floating power plant ships from the United States, prefabricated harbours set up along the French coast for invasion landings, measures taken to detect where the Germans and Italians dropped magnetic mines in the Suez canal, and others.

"Water was the great problem in the desert," he said, in outlining the laying of pipe lines from Alexandria to the desert fighting grounds. Eventually the pipe lines ran nearly to Bardia. He described setting up water filtration facilities when a camp for 10,000 men had to be established within a fortnight.

Among the more usual duties of the engineer road communications were built, bridges were thrown across the Suez canal and over the Tigris and Euphrates, and harbour repairs made at Bengazi and Tripoli. An eight-berth deep water harbour was built on the eastern side of the Suez, and another harbour of six berths and quays constructed some 300 miles down the coast.

Airfields were constructed in the desert, and railways were built along the coast and through the Nile valley. To offset floods which carried away the roads they were laid in a sort of mighty ditch. Flood waters then only buried them and they could later be dug out for re-establishment. The engineers, too, had to set up land mine manufacturing facilities in Egypt. Starting from a primitive plant they developed until more than 13 million anti-tank mines were made.

Dr. C. J. Mackenzie of the National Research Council thanked the speaker. Chairman Norman Marr of the Ottawa Branch of the Institute presided. A large number of military and naval engineers attended.

SAGUENAY BRANCH

H. R. Fee, M.E.I.C. - - *Secretary-Treasurer*
J. T. Madill, Jr.E.I.C. - *Branch News Editor*

A joint meeting of the Saguenay Branch of the E.I.C. and the Saguenay Section of the Chemical Institute of Canada was held on March 23rd. C. P. Brockett, the section chairman of the C.I.C., introduced the speaker, Dr. John J. Grebe of Dow Chemical Company, Midland, Mich. Dr. Grebe spoke on the subject **Cathodic Protection.**

The general subject of corrosion was considered to show just what was involved. Three dimensional type slides of electron-microscope work were used to illustrate this part of the talk and were of great interest to the meeting.

The speaker then discussed a number of very interesting cases where corrosion problems were solved by cathodic protection. Several of these installations were illustrated with pictures. Accompanying graphs were used to show the operating conditions and results. The economics of cathodic protection as contrasted with other means of corrosion protection were outlined.

The meeting closed after a very interesting discussion period.

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At a meeting of the Saguenay Branch held on April 17th, in the Arvida Protestant School, Mr. W. J. Tomlinson, technical director of Betz Laboratories Ltd., Montreal, presented a paper entitled **Boiler Water Conditioning**.

The speaker dealt only with the external treatment of boiler feed water as contrasted with internal treatment. The several alternative methods of water treatment with the simplified associated chemical reactions were outlined very clearly. Advantages and disadvantages of the different types were discussed and the type of impurity for which each was best suited was developed.

The meeting was adjourned after the questions of the members were very satisfactorily answered by the author.

* * *

At a meeting in the Arvida Protestant School on Wednesday, May 9th, 1945, Mr. R. J. Anderson, engineer-in-charge of Union-Melt Welding, Dominion Oxygen Co. Ltd., Toronto, spoke on the **Flame Priming of Metal Surfaces.**

The speaker defined "flame priming" as a practical means of approaching the ideal in preparation of a surface to receive paint of the ordinary bituminous, plastic or enamel types. With these few introductory remarks a film was presented showing the flame priming and painting of the Grand Coulee Gates.

This film gave a general idea of the process after which the speaker outlined some of the very interesting background facts which had led to the development of the process. The subject of scale on steel surfaces was discussed and the method by which scale in certain condition causes deterioration of paint surfaces was developed. The action of the flame priming on surface scale was then outlined.

The speaker discussed the apparatus required, illustrating the remarks with actual pieces of equipment and then outlined very clearly the controls necessary in the process and the practical means of obtaining satisfactory control. It was stated that the process gave beneficial results under moderate corrosion conditions and very startling results under extreme conditions. The remarks were concluded by a short film showing the process in use on canal gates near Montreal.

After the questions raised by members had been dealt with the meeting adjourned.

* * *

Mr. Norman Holland, president and managing director of Brandram-Henderson, Ltd., Montreal, addressed a joint meeting of the Saguenay Branch of the Engineering Institute and the Saguenay Section of the Chemical Institute of Canada on May 16th, 1945, on **The Uses and Abuses of Paint and Varnish.**

The speaker briefly discussed the various types of varnish; the spirit type, long-oil type, and short-oil type, and described several of the gums, resin and oils used in their manufacture. He then described the various methods of grinding the paint and defined paint as a pigment in oil, and enamel as a pigment in varnish, with numerous grades in between.

Mr. Holland dealt chiefly with the misuse of paint and varnish, ascribing most of the trouble to the unwillingness of people to read the directions on the label. The most frequent abuses were—

(1) Use of an improper type of finish.

(2) The improper preparation of the surface to be covered.

(3) Improper priming.

(4) Insufficient number of coats.

Throughout his talk Mr. Holland emphasized the fact that the labour costs were the same regardless of the quality of paint used, and that the cost of the paint represented a very small portion of the total outlay. The most economical procedure was therefore to use high grade products, since the cost should be based, not on dollars per gallon, but on years per dollar.

With regard to the so-called plastic paints, Mr. Holland believed that undoubtedly much could be looked for from these finishes, but that indiscreet publicity had lead the public to expect much more than could be realized.

Aluminum paint has established itself in the past, and has a big future, provided the vehicle used is of high quality. Unfortunately some manufacturers have used an inferior quality vehicle as a base for aluminum paint, and the result had been detrimental to the product in general.

The speaker was introduced by C. Miller, and a vote of thanks was moved by Norman McCaghey.

VANCOUVER BRANCH

J. G. D'Aoust, M.E.I.C. - *Secretary-Treasurer*
P. B. Stroyan, M.E.I.C. - *Branch News Editor*

On May 17th about forty-five members of the Vancouver Branch gathered to hear a particularly interesting address by Mr. John H. Maude, chief designer of the industrial machinery division of the Dominion Engineering Company, Limited, Montreal. Mr. Maude spoke on **Improved Hydraulic Presses for Wartime Requirements,** commencing with a review of developments in this machinery since the days of the last war. This type of equipment was then quite archaic when compared to the oil-hydraulic presses built to exert pressures up to two thousand tons. The speaker quoted statistics to emphasize the fact that Canada's industrial accomplishments during this war have been nothing short of miraculous when one considers the almost negligible output of the heavy industries five years ago. The principal theme was the speeding up of the manufacture of shell-cases and shell-forgings due to the use of improved oil-hydraulic presses. A variety of diagrammatic and photographic slides showed the new developments in this type of machine, notably the radial piston pump which created the tremendous pressure necessary, and the intricate valve controls which ensure the speed and flexibility of this particular machine. A unique hydraulagraph had been devised to register a graphic record of the rapidly changing pressures for each second of a particular operation, producing a diagram which not only gave this information for a working cycle but also indicated exactly how many seconds were being wasted by the operator between cycles, thus enabling these time losses to be analyzed and eliminated.

Shell-cases of different sizes were exhibited, indicating the fine workmanship possible under these mass production methods. Special forgings with plug inserts indicated lines of flow of the metal in the billets during the process of forging under the press.

The number of questions asked and the lengthy discussion indicated the interest taken by the members in this most detailed and absorbing presentation.

WINNIPEG BRANCH

A. T. McCormick, M.E.I.C. - *Secretary-Treasurer*
V. W. Dick, M.E.I.C. - - - *Branch News Editor*

A joint general meeting of the Winnipeg branch and the Professional Engineers of Manitoba was held in Theatre " F ", University of Manitoba, Thursday, May 3rd, under the chairmanship of J. W. Battershill, at which was shown the coloured sound motion picture " Lifeline of the Nation ", supplied by the Association of American Railroads, and " Tornado in a Box " supplied by Allis-Chalmers Ltd.

Before the showing of the films, Dean E. P. Fetherstonhaugh, president of the Institute, gave a short résumé of his recent trip to the Maritimes and brought greetings from the eastern branches.

The film " Lifeline of the Nation " stressed the importance of the railways in the U.S.A. to that country's war effort. The views shown were very interesting and the colour photography excellent.

G. R. Pritchard, of the Canadian General Electric Co., gave a short introduction to the next film " Tornado in a Box ", which was a descriptive film on the theory and operation of the gas turbine. The information was presented in an interesting manner and was enjoyed by all present.

In the discussion period, J. T. Dyment, engineering superintendent of Trans-Canada Ailways, gave an interesting review of the future possibilities of the gas turbine combined with jet propulsion as applied to aeroplanes. Prof. N. W. Hall stated that the gas turbine operates on the usual type of heat cycles, and depends greatly on the efficiency of the air compressor and advances in metallurgy. He pointed out that its greatest advantage for many applications was the fact that it required no water for its operation.

READING LIST FOR JUNIOR ENGINEERS

Revised by the Junior Committee on Professional Training, Engineers' Council for Professional Development, 29 West 39th Street, New York 18, N. Y.

(E. I. C. Representatives: J. W. Brooks, J. A. Ouimet).

INTRODUCTION

"Two of the most important attributes the successful engineer must possess are first, the ability to deal with men and affairs and second, the ability to read and absorb the written experience of others. These abilities are seldom found fully developed in any man. Generally, they must be developed by the individual himself and usually after formal education is completed.

The Reading List given here, based upon recommendations by a number of eminent men, many of them distinguished engineers, is presented especially for the junior engineer who is desirous of broadening himself and developing a full professional life. The titles are, we hope, suggestive and will attract the reader and lead him to explore further. It is expected that they will provide a basis on which the nontechnical culture of the engineer can be continued.

A few words of advice may be in order. Over a period of about four years a minimum of twenty-five of these books might be selected and read, with the limiting recommendation that the selection made will include at least one book in each classification. Read a few books well and make their thoughts your own, rather than skim many and absorb nothing. Develop reading habits outside of your technical specialty—it will profit you much in enjoyment and mental stimulation. Since 'reading maketh a full man and writing an accurate one,' practise the reduction of your thinking into written words so that you may perfect yourself in accuracy of expression." (Preface to original 1936 list.)

Each book in this revised reading list has been read or reviewed by one or more members of the committee. It meets the standards set for the inclusion of a book in this tabulation.

The committee, in its work, has striven to eliminate textbooks, encyclopedic works, and volumes difficult to obtain. We have, inasmuch as advisable, eliminated those books which are modern best sellers but we have, however, evolved a systematic method of guaranteeing the inclusion of best sellers after a period of time. In operation this system will work as follows: Each year the Junior Committee will include, in a mimeographed addition to the printed listing, five current best sellers. These may cover any field of literature. After five years on the addenda a book is eligible for transfer to the master reading list or for elimination and discard. This rotating plan will maintain an addenda of 25 to 45 books, assuming that the reading list will be revised every five years. It also assures that proper weight and emphasis will be given to the matters of current interest.

We constantly have kept in mind the chief purpose of this compilation: that of guiding the young engineer to proper and competent sources of cultural and intellectual fields outside of the specific profession. We do not think the books listed here are, in every case, the best obtainable but we do feel that each selection answers admirably the main purpose of the list, namely, to serve as an introduction to vast territories of human achievement and to interest the junior engineer in fields that may be explored with attendant cultural profit. We further assume that most engineers will be acquainted with the great and familiar works of literature and religion such as Shakespeare's plays, Milton's poems, the Bible, and the novels of authors such as Dickens, Stevenson, Mark Twain and others. However, in case several modern classics such as Clarence Day's "Life with Father"; Hilton's "Good-Bye, Mr. Chips"; and Benet's "John Brown's Body" might become lost in the shuffle, we have seen fit to include these and other similar works.

The result presented here represents approximately four years of meetings and the present committee is the second to have worked over this problem. We acknowledge with thanks the help of many persons too numerous to mention.

R. F. Broas	Don Reynolds
J. W. Brooks	Alistair E. Ritchie
Doak O. Conn	Edward Wesp, Jr.
G. W. Dyson	F. J. Van Antwerpen, *Chairman*
Cornelius Kirby	J. T. Sherman, *Advisory Member*

NATURAL SCIENCE

Carrel, Alexis. Man the Unknown. Harper, 1935.
Presents a synthesis of what psychologists, biologists, chemists, and physicists have learned about the nature of man, and then goes on to show how a stronger healthier race may be developed.

Clendening, Logan. The Human Body. Knopf, 1937.
Unusually interesting book on the intricacies of the human body for the adult reader. To be read for an intelligent understanding of one's body and the mechanisms that make it go.

Dampier-Wetham, W. C. History of Science and Its Relation to Philosophy and Religion. Macmillan, 1929.
Evolution of scientific thought and resesrch from dawn of history in Babylonia and Egypt, through the speculations of Greece, and past the blind alleys of the Middle Ages to the present.

Darwin, C. G. Origin of the Species. London, J. Murray, 1859.
The preservation of favored races in the struggle for life.

De Kruif, Paul. Microbe Hunters. Harcourt, Brace, 1926.
Biographical sketches of scientists and their work in the field of bacteriology and microscopy. Accurate yet adventuresome style.

Eddington, A. S. The Nature of the Physical World. Macmillan, 1928.
Takes up both relativity and the quantum theory and traces the effect of modern concepts on Free Will and Determinism.

Einstein, A. and Infield, L. The Evolution of Physics. Simon and Schuster, 1938.
Seeks to deal with the great revolution of this century's interpretation of the realities behind physical events. It is an attack on a position of enormous difficulty and has been conducted with remarkable and at times brilliant clarity.

Haldane, J. B. S. Adventures of a Biologist. Harper, 1940.
The author tackles in this book some of the unsolved problems of science and human destiny. It is compounded from his broadcasts, lectures, and essays over the previous seven years.

Hogben, Lancelot. Mathematics for the Millions. Norton, 1937.
This book is written to popularize mathematics. It stresses the historical and social aspects. After chapters on the early history of mathematics, the author takes up arithmetic, geometry, trigonometry, calculus, etc., in their various phases and explains their nature and shows how they can be applied to life's problem.

Hogben, Lancelot. Science for the Citizen. Knopf, 1938.
Explains the topics in six main themes. These are: the story of man's conquest of time-reckoning and earth-measurement, of material substitutes, of new power resources, of disease, of hunger, and behavior. Clocks, calenders, astronomy, geometry, navigation, and mechanics are discussed historically and technically.

Jaffe, Bernard. Men of Science in America. Simon and Schuster, 1944.
Presents a broad picture of the growth of science in the U. S., told in the lives of America's great scientists themselves. It covers virtually every field of science in which Americans have played a major part during the past three and a half centuries. Among the scientists discussed are W. T. G. Morton (anaesthetist); M. F. Maury (hydrographer), E. O. Lawrence (nuclear physicist), L. F. R. Agassiz (biologist), Benjamin Franklin, Joseph Henry, S. F. B. Morse, and others.

Kasner and Newman. Mathematics and the Imagination. Simon and Schuster, 1940.
A book of popularization in which the authors reveal some of the tricks, some of the flights of fancy, the fascinations of higher mathematics.

Menninger, Karl. The Human Mind. Knopf, 1937; Garden City.

Zinsser, Hans. Rats, Lice, and History. Little, Brown, 1935.
This is the biography of typhus, a disease known since 1490 during the civil wars in Spain. In his discoursive opening chapters, Dr. Zinsser takes up the relationship between science and art, then the history and changing nature of infectious diseases and epidemics in general. Of the fourfold relationship of louse, rat, man, and typhus, the life history and character of the louse is first discussed.

PHILOSOPHY

Browne, Lewis. This Believing World. Macmillan, 1930.
A fascinating account of the development of the chief modern religions.

Cabot, R. C. Meaning of Right and Wrong. Macmillan, 1933.
A popularly written volume in which a professor of social ethics at Harvard sets forth the fundamental principles of ethics as they apply to the needs of modern life. He finds the main basis of right to be fidelity to agreements with one's self and others; the chief wrong, self-deceit.

Day, Clarence. God and My Father. Knopf, 1932.
The portrait of a hot tempered and masterful father by an unusually outspoken son. The author tells of his father's fearless relations with his God, his impatient endurance of his pastors, and the conflict of his high spirited views with the faith of his wife.

Dimnet. Art of Thinking. London, J. Cape, 1929.
The purpose of this book is to convince men and women who are neither morons nor geniuses that they can nevertheless have a vigorous and interesting mental life of their own, a life that is more than the mere parroting of current shibboleths, which has become the popular substitute for thought. He convinces us that we can ourselves become the masters of the art of thinking by pointing out those rare intervals in our own mental experience when our insight has been the clearest.

Durant, William J. The Story of Philosophy. Garden City, 1933.
The essential thought of the great philosophers from Plato to John Dewey is readably and humanly presented.

Eddington, A. S. The Expanding Universe. Macmillan 1933.

Emerson, Ralph Waldo, Selected Writings of Ralph Waldo Emerson.Modern Library. Teacher and philosopher who influenced the American mind in the nineteenth century.

Hocking, W. E. Types of Philosophy. Scribner, 1929.
A study in which the history of philosophy and its leading problems are combined through an analysis of the various types of philosophy. It is a text intended primarily for beginners in philosophical study.

Link, Henry C. Return to Religion. Macmillan, 1936.
A psychologist's account of his own conversion through the experiences he encountered in advising some 4000 individuals over a period of 15 years in their problems of personality, happiness, love, marriage, and general living.

Lin, Yu-T'ang. My Country and My People. Reynal & Hitchcock, 1935.

Lippman, Walter. A Preface to Morals. Macmillan, 1929.
A book setting forth the belief that what is required for successful conduct in modern society is objectivity and loyalty to reality rather than to persons and desires, and contending that both intuition and scientific knowledge go to prove that virtue is the means to happiness.

Robinson, James H. The Mind in the Making. Harper, 1931.

Robinson, James H. The Human Comedy. Harper, 1937.

Spinoza, Baruch or Benedict. Treatise on Religious and Political Philosophy. 1670; Ethics. 1675.
Spinoza's belief—the distinction between things of the spirit and material things is but superficial. There is one elemental substance, and that is infinite, depends upon nothing, and nothing depends on it. It is the cause of all, even of itself. To man God is known as thinking an extended substance. What is real in the individual is God. There is no free will for the human being.

ECONOMICS AND SOCIOLOGY

Arnold, Thurman W. Folklore of Capitalism. Yale University Press, 1937.
Presents ideas about social organizations, which are not regarded as folklore, but accepted as fundamental principles of law and economics.

Burlingame, Roger. March of the Iron Men. Scribner, 1938.
A social history of union through invention. The influence of inventions and technology on our democratic institutions through 1865.

Burlingame, Roger. Engines of Democracy. Scribner, 1940.
Continuing "March of the Iron Men."

Chase, Stuart. The Tyranny of Words. Harcourt, Brace, 1938.
A book on thinking and logic, in which the author explores the fields of semantics and applies his proposed discipline of language to such modern terms as "New Deal," "idealism," "liberty," "Fascism," etc.

Childs, Marquis. Sweden; the Middle Way. Yale University Press, 1936.
An exposition of the cooperative movement in Sweden, as it affects production, distribution, and consumption.

Churchill, Winston. The World Crisis. 1923-29.

Cole, G. D. H. Guide Through World Chaos. Knopf, 1932.
The main part of the book is a discussion of the causes, both immediate and underlying, of the world economic depression. Mr. Cole shows that as the crisis is world-wide, so the remedies must be world-wide. An Englishman, he writes from the standpoint of a citizen of the world.

Daniels, Jonathan. A Southerner Discovers the South. Macmillan, 1938.
Mr. Daniels throws light upon many questions, presenting perhaps the best available summary of Southern problems as they stand today.

Flanders, Ralph E. Taming Our Machines. R. R. Smith, 1931.
Attainment of human values in a mechanized society. Written in a popular manner in simple style. A fresh view of the world's present troubles.

Lynd, R. S., and Lynd, H. M. Middletown in Transition. Harcourt, Brace 1937.
Presents a record of forty years of change as a sequel to the authors' earlier book "Middletown," which was "a study in contemporary American culture."

Marx, Karl. Capital. Charles Kerr, 1907-08.
A critique of political economy. Written originally to make plain the fallacy of capitalistic economy, and still held to be the source from which anticapitalistic movements draw their constructive power.

Mann, Thomas. I Believe.

Martin, Everett D. The Meaning of a Liberal Education. Norton, 1926.
The author employs the useful device of describing what a liberal education is by contrasting it with what it is not. He writes mainly of the difference in propaganda and education and claims the educator and the propagandist have nothing in common.

Thoreau, Henry D. The Heart of Thoreau's Journals, ed. Odell Shepard; Houghton, Mifflin, 1927.
Waldon; or Life in the Woods.
It is the handbook of an economy that endeavors to refute Adam Smith and transform the round of daily life into something nobler than a mean gospel of plus and minus.

PSYCHOLOGY

Crane, G. W. Psychology Applied. Northwestern University Press. 1932.

Overstreet, H. A. Influencing Human Behavior. People's Institute, 1925.
How to harness psychology to the task of achieving success is the theme of the book. The author puts the purpose of it into such sentences as "Life is many things, but at the center of it all is this. It is the process of getting ourselves believed in and accepted." How to achieve that end in whatever way and for whatever purpose is what he sets forth basing all his principles, arguments, and methods on the findings of psychology.

Powys, J. C. Meaning of Culture. N. Y. Norton, 1929.
Culture is defined and placed in relationship to philosophy, religion, and the art of human relations.

Smith, Elliott Dunlap. Psychology for Executives. Harper, 1934.
Deals with themes such as habits and how to handle them, personality, self-control, and the effect of group psychology in industry.

Trattner, E. R. Architects of Ideas. Carrick, Evans, 1938.
The purpose of this book is to justify the author's admiration for fifteen of the greatest theorists who have an impressive contemporary implication and to do away with his reader's vagueness as to just what each one of them stands for in the gallery of human eminence.

Veblen, Thorstein B. The Theory of the Leisure Class. Viking, 1912.
An economic study of institutions, based on the simple thesis that the present middle-class society does not produce and consume wisely or with any sense of proportion.

Viteles, Morris. Science at Work. Norton, 1934.
The application of sound principles of psychology in the field of industrial relations.

BUSINESS AND INDUSTRIAL MANAGEMENT

Dennison, Henry. Organization Engineering, McGraw-Hill, 1931.
Well written and shows original observations and analysis. Presents an over-all picture of the whole problem rather than a discussion of specific situations. The intent of the volume is to encourage further development of the art and science of organization.

Harding, C. F. Business Administration for Engineers, McGraw Hill, 1937.
Sets forth in the engineer's language the organization, economic, and managerial problems of the industries and public utility corporations with which he is likely to be associated. Outlines an avenue of executive advancement for the engineer.

Walton, A. Do You Want to Be a Foreman? McGraw-Hill, 1941.
A readable analysis of foremanship, to give prospective foremen a sound idea of what being a foreman means—then to help them set their mind to it and fit themselves both in temperament and ability for the responsibilities that will come to them as foremen.

LITERATURE, INCLUDING POETRY, ESSAYS, AND FICTION

ADLER, MORTIMER J. How to Read a Book. Simon and Schuster, 1940.
The first section discusses reading in relation to learning and thinking, whether in school or out. The second part, the meat of the book, tells us how and what to read. The third part, called The Rest of the Reader's Life, deals with the basic reasons for literacy. It discusses the obligations of the citizens of a democracy and expounds the thesis that free minds make free men.

AUSLANDER, J., AND HILL, F. E. The Winged Horse. Doubleday Page, 1930.
Fluently written, not too pedantic narrative of the course of English poetry, beginning with Chaucer down to Stephen Vincent Benet and Leonil Adams. The co-authors are men sensitive to poetic beauties, appreciative of the poets' task, and convinced of the comforting and enabling functions of truly great poetry.

BALZAC, HONORE DE. Pere Goriot. Paris, Charpentier, 1846; N. Y. Burt, 1886.
A comedy.

BENET, STEPHEN VINCENT. John Brown's Body. Farrar & Rinehart, 1928.
A book length epic poem of the Civil War. The author conveys with fine fervor the sense of doomed and twisted destiny which overshadows the Civil War or war between the states. He grasps in powerful hands the violent contrast between the America of Lee and John Brown and that of "the great metallic beast expanding West and East" that is the America of today.

BUCK, PEARL. The Good Earth. Reynal & Hitchcock, 1931.

BUTLER, SAMUEL. The Way of All Flesh. Macmillan, 1903.
The hero is reared in an ecclesiastical environment against which he rebels. The book is an attack upon the Victorian pattern of family life.

CHAUCER, GEOFFREY. Canterbury Tales. Westminster, England, Caxton, 1484.
Truth ballads of good counsel.

CONRAD, JOSEPH. Lord Jim. Modern Library, 1931; Doubleday Page, 1916, 1923; McClure-Phillips, 1903.
A romance of the sea.

DAY, CLARENCE. This Simian World. Knopf, 1920.
Ours is a Simian civilization. If we had not descended from the monkey, what would our world be like from the point of view of exterrestrial beings?

DICKENS, CHARLES. David Copperfield. Macmillan, 1849-1850.
The personal history, adventures, experiences, and observations of David Copperfield, the youngster of Blunderston Rookery.

DOSTOYEVSKY, FEODOR. Brothers Karamazov. Modern Library, 1943.
This is considered one of the great productions of the world. It tells the story of Old Karamazov (Russian) and his three sons.

FROST, ROBERT. Collected Poems. Holt, 1939.
Present six of the author's books: (1) A Boy's Will; (2) North of Boston; (3) Mountains' Interval; (4) New Hampshire; (5) West Running Brook; and (6) A Farther Range.

FURNAS, C. C. The Next One Hundred Years. Reynal & Hitchcock, 1936.

GALSWORTHY, JOHN. Forsyte Saga. Scribner, 1922.

HILTON, JAMES. Good Bye, Mr. Chips. Little, Brown, 1934.

JBSEN, HENRIK. An Enemy of the People; The Wild Duck. Modern.

IOWETT, BENJAMIN. Plato—The Republic. Clarendon Press, 1902 and Modern Library.
A demonstration of justice by picturing an ideal state.

KIPLING. Kipling Pageant. Doubleday, Doran, 1935.
Short stories and chapters from some of Kipling's books, and ninety pages of verse. Here are such immortalities as "The Man Who Would Be King," "Without Benefit of Clergy," "Brugglesmith," "Wireless," and "The Brushwood Boy."

MELVILLE, HERMAN. Moby Dick.

MONTAIGNE, M. E. Essays. London, Becker, 1943.
These essays, tolerant in spirit, familiar and easy in style, set forth the author's philosophy, epitomized in his phrase "Que-sais-Je?" and with a wealth of detail, draw a picture of the man himself.

PALGRAVE, F. T. The Golden Treasury.

SAINT EXUPERY, ANTOINE. Wind, Sand and Stars. Reynal & Hitchcock, 1939.

SHAKESPEARE, WILLIAM. Plays and Sonnets. G. Routledge, 1852.
Presents a collection of the works of Shakespeare, one of the world's greatest poets and dramatists.

STEINBECK, JOHN. Grapes of Wrath. Sun Dial, 1941; Modern Library Edition, 1941.
A story of agricultural migrants to California.

UNTERMEYER, LOUIS. Modern American Poetry. Harcourt, Brace, 1942.
One of the best anthologies of American poetry.

VAN DOREN, MARK. American Poets. Little, Brown, 1932.
Selections from 57 Poets from 1630 to 1930.

WHARTON, EDITH. Ethan Frome. 1911. Scribner, 1938.
A short tragedy of the Massachusetts hills.

WHITMAN, WALT. Leaves of Grass.

WOLFE, T. Of Time and the River. Sun Dial Press, 1935.
Presents a magnificent epic of American life and where the life of North Carolina is dominant the novel is at its best.

HISTORY

BEARD, C. A., AND BEARD, MRS. M. Rise of American Civilization. Macmillan, 1930.
A delightful history giving a true picture of past events and an appreciation of our great American heritage. Social, economic, and political history and interpretation.

BROOKS, VAN WYCK. The Flowering of New England. Merrymount Press, 1941.
Presents a study of the New England as it has found expression in the lives and works of writers.

CHASE, STUART. Rich Land, Poor Land. Whittlesey House (McGraw-Hill) 1936.
A study of America—a vast and luxurious continent—before the coming of the white man, compared with the forests, water erosion, destruction by water pollution, toll of mineral and power exploitation of today and the implications that may be drawn from this, with respect to the need for a national plan of conservation, social and economic considerations, and our responsibility to future generations.

CHURCHILL, WINSTON. The Eastern Front. 1931.

LASKI, HAROLD J. The American Presidency, Harold J. Harper, 1940.
A scholarly analysis and interpretation of the supreme political office in the U. S. by an Englishman privileged to observe its workings from near at hand and with the benefit of criticism of American friends. A penetrating study and a keen estimate of the Presidency, indicating the traditions, conventions, and laws in their relationship to the Cabinet and the Congress, and the people themselves.

MORISON, SAMUEL E., AND COMMANGER, HENRY S. The Growth of the American Republic. Oxford, 1939.
A general survey of United States history.

MUMFORD, LEWIS. The Culture of Cities. Harcourt, Brace, 1938.
A survey of the history of cities from medieval times to the present with proposals for the betterment of the city of today and tomorrow.

TOLSTOI, L. N. War and Peace. Heritage Press, 1943.
A prose epic of the Napoleonic wars in which are reflected the psychology, philosophy, and inner aspirations toward the self-release of the Russian people.

WELLS, H. G. Outline of History (new and revised). Garden City Publishing Co., 1931.
A readable commentary on the life of man from the time of the stone age.

BIOGRAPHY AND TRAVEL

BEVERIDGE, ALBERT J. The Life of John Marshall. Houghton, Miffling, 1916-1919; Republished 1929.
The constitutional opinions of John Marshall grew out of serious public conditions, national in extent. The effort is made to relate the circumstances that required him to give to the country these marvelous state papers. In order to understand the full meaning of his deliverances and to estimate the just value of his labors, it is necessary to know the historical sources of his foremost expositions of the constitution. In these volumes a history of the times of John Marshall is presented.

CELLINI, BENEVENUTO. Autobiography. Pocket Books, 1940.
Cellini lived from 1500-1571. He was an Italian sculptor, metal worker, and author. This story reveals one of the most spectacular and singular careers in the history of art.

CHURCHILL, WINSTON. My Early Life; 1930.
Thoughts and Adventures, 1932.

CURIE, EVE. Madame Curie. Doubleday, 1937. The life story of the co-discoverer of radium, written by her younger daughter. This biography is facinating as a record of scientific research.

Dana, R. H. Two Years Before the Mast. Macmillan, 1933.
The author shipped as a common sailor around Cape Horn to California. The narrative of this voyage is an American classic of the sea and is a vivid account of a sailor's life in the great days of American sailing.

Freeman, Douglas. Robert E. Lee: A Biography. Scribner, 1934-35.
The leader of the Confederate Army.

Lawrence, T. E. The Seven Pillars of Wisdom. Viking, 1926.
The story of the author's political and military adventures in Arabia.

Plutarch. Lives. Cork University Press, 1937.
Forty-six historical biographies arranged in pairs, the life of a Greek being followed by the life of a Roman. A classic of biographic style.

Stefanson, Vilhjalmur. Northward Course of Empire. Macmillan.
The author because of his sound understanding of our New Arctic frontiers has been one of the first to realize the possibilities of this Northward Empire. He has written of it in a serious mood and wishes it to be taken seriously by thoughtful minds

Steffens, Lincoln. Autobiography. Harcourt, Brace, 1931.
The life story of an American reporter, journalist, student of ethics and politics, a muckraker in the days of the early 20th Century. Attempts to reform government. He was a friend of city bosses, foreign dictators, youthful radicals, and disillusioned, loving optimists.

Vallery-Radot. The Life of Pasteur. Garden City, 1937.

Zinsser, Hans. As I Remember Him. Little, Brown, 1940.
Biography of a physician, one R. S., reputed to be a friend of the author, but probably the author himself. R. S. was born of German parents somewhere in Westchester. The book is the story of his growth from babyhood to manhood, his school days, his choice of medicine as a profession, and his work as an interne in the slum district of New York in the 1900's. His later career as a bacteriologist in Siberia, Russia, Egypt, Mexico, and the Orient is traced.

ART

Bulley, M. H. Simple Guide to Pictures and Painting. Dutton, 1928.
Deals with principles of construction—design, personality, craft, tradition, and the ways in which a painter works. Outlines the development of painting from Byzantine to modern French.

Cheney, Sheldon, and Cheney, Martha. Art and the Machine. McGraw-Hill, 1936.
An account of industrial design in 20th Century America.

Cheney, Sheldon. A World History of Art. Viking, 1937.
History of art in all its phases from its earliest beginnings to the present. Mr. Cheney has de-emphasized history as such and has attempted rather to stress the qualities of greatness in the outstanding works of art throughout history.

Craven, Thomas. Men of Art. Simon & Schuster 1931.
Includes not only an outline of art, a history of painting and sculpture but the author makes living figures of his "Men of Art" working against the background of their times.

Orpen, Sir William. Outline of Art. Putnam, 1923.
Two large volumes describing briefly the works of artists from ancient to modern times. Easily read and profusely illustrated, hence can be skimmed through or absorbed at leisure.

GENERAL

Fowler, Henry W. Concise Oxford Dictionary of Current English. Oxford University Press, 1926.
A large amount of information in very little space.

CANADIAN TITLES

In order to supplement the list prepared by ECPD, the following books of Canadian origin are suggested as worth reading.

Bladen, V. W. Introduction to Political Economy. Toronto, University of Toronto Press, 1941.

Brady, Alexander. Canada. Lond., Benn; Toronto, Macmillan, 1932.

Creighton, D. G. Dominion of the North. Boston, Houghton-Mifflin, 1944.

Dawson, R. M. The Civil Service of Canada. London, Oxford University Press, 1929.

Hutchison, Bruce. The Unknown Country. Longmans, Green & Co., Toronto, 1943. Canada and its people.

Leacock, Stephen. Elements of Political Science. Boston, Houghton-Mifflin, 1931.

Mackay, R. A. The Unreformed Senate of Canada. London, Oxford University Press, 1926.

Supplement to Reading List for Junior Engineers 1944-45

Prepared by the Junior Committee on Professional Training Engineers' Council for Professional Development

Note: In its task of revising the Reading List for Junior Engineers (for 1945 edition) the committee was faced with the necessity of limiting the number of titles listed. Many books reviewed and recommended for inclusion in the list have not been proven by time to be classics. Some such titles have been placed on the supplement. It is expected that many will in time be shown to be of passing interest only. These will be dropped from future supplements. Others may be expected to contain lasting values and will eventually, in the course of subsequent revision, be added to the recommended reading list. This supplement is in no way a reflection of the opinions or convictions of the committee or the Engineers' Council for Professional Development.

Adamic, Louis	From Many Lands
Asch, Sholom	The Nazarene; The Apostle
Basso, Hamilton	Sun in Capricornia
Benchley, Robert	Inside Benchley
Burnett, Whit	This is My Best
Brookings Institution	Price Making in a Democracy
Caldwell, Erskine	Say! Is This the U.S.A.?
Chase, Stuart	The Economy of Abundance; Goals for America
Cobb, Irvin	Exit Laughing
Cooke, Charles	Playing the Piano for Pleasure
Corbin, Hazel	Getting Ready to be a Father
Cronin, A. J.	Keys to the Kingdom
DePoncins, G.	Kabloona
Douglas, Lloyd	The Robe
Duranty, Walter	U.S.S.R.
Drago, Harry	Buckskin Empire
Fadiman, Clifton	Reading I've Liked
Flynn, John	As We Go Marching
Haig, R. S.	Timber
Hawes, E.	Men Can Take It
Hersey, John	A Bell for Adano
Hawkins, John	Pilebuck
Hutchins, R. M.	Education for Freedom
Joad, C. E. M.	God and Evil
Johnson, Eric	America Unlimited
Kirby, R. A., and Lawson, P. G.	The Early Years of Modern Civil Engineering
Lampland, R.	Hobbies for Everybody
Laski, H. J.	Reflections on the Revolution of Our Time
Leacock, Stephen	How to Write
Lerner, Max	It's Later Than You Think
Levy, John	The Happy Family
Lewis, E. St. Elmo	Going to Make a Speech?
Lewis, O.	The Big Four
Lin Yu T'ang	Between Tears and Laughter
Lippman, Walter	U.S. Foreign Policy; U.S. War Aims
McInnes, H.	While Still We Live
Mueller, H. R.	Years of This Land
Myers, Garry C.	The Modern Parent
Nehru, Jawahalal	Glimpses of World History
Perleman, S. J.	Look Who's Talking
Perkins, J. R.	Trails, Rails, and War
Queeny, Edgar	The Spirit of Enterprise
Ray, Randolph	Marriage Is a Serious Business
Sandburg, Carl	Life of Lincoln
Saroyan, William	The Human Comedy
Sforza, Carl	Contemporary Italy
Smith, Betty	A Tree Grows in Brooklyn
Spence, Hartzell	One Foot in Heaven
Standish, R.	The Three Bamboos
Steinbeck, John	The Grapes of Wrath
Steinman, D. B.	Bridges and Their Builders
Sublette & Kroll	Perilous Journey
Sullivan, Lawrence	Bureaucracy Runs Amuck
Symposium	Preface to Peace
Terrell, John	Plume Rouge
Toney, Volta	You and Your Congress
Van Passen, Pierre	Days of Our Years
Weld, John	The Pardners
Wolf, A.	History of Science, Technology and Philosophy in the 16th and 17th Centuries
Woodbury, D. O.	Beloved Scientist

Library Notes

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

ADDITIONS TO THE LIBRARY

TECHNICAL AND NON-TECHNICAL BOOKS

Examples of Astronomic and Geodetic Calculations for the use of Surveyors:
E. Deville. Canada, Board of Examiners for Dominion Land Surveyors, 1878. 109 pp., illus., 8¾ x 6 in., leather.

Fundamentals of Thermodynamics:
Arthur Stanton Adams and George Dewey Hilding. Harper & Brother, New York and London, c1945. 289 pp., illus., 9½ x 6½ in., leather.

Simplified Design of Structural Steel:
Harry Parker. John Wiley & Sons, New York, c1945. 226 pp., illus., 8 x 5¼ in., leather.

Twenty Careers of To-morrow:
Darrell and Frances Huff. Whittlesey House, McGraw-Hill, New York and London, c1945. 281 pp., illus., 8¼ x 5½ in., cloth.

PROCEEDINGS, TRANSACTIONS, REPORTS, ETC.

American Institute of Consulting Engineers:
Proceedings of the Annual Meeting, 1945; Standardized Intelligence by Hardy Cross (Address of guest speaker).

American Society of Mechanical Engineers:
Transactions, v 66, 1944.

Canada—Department of Labour:
Labour Legislation in Canada, 1943. Ottawa, King's Printer' 1944.

Canada—Department of Trade and Commerce:
Canada 1945; the Official Handbook of Present Conditions and Recent Progress. Ottawa, King's Printer, 1945.

Corporation of Professional Engineers of Quebec:
Annual Report, 1944.

Institution of Mining and Metallurgy:
List of Members, 1945.

Institution of Naval Architects:
Transactions, v 86, 1944.

McGill University:
Annual Convocation, 1945.

Nova Scotia—Board of Commissioners of Public Utilities:
Annual Report, 1944.

TECHNICAL BULLETINS, ETC.

Canada—Department of Mines and Resources—Dominion Water and Power Bureau:
Water-Power resources of Canada; annual review, March 15, 1945. (No. 2151) in French and English.

Electrochemical Society: Preprints:-
87-21: Magnesium-Copper Sulfide Rectifier by Samuel Ruben.—87-22: Characteristics of the Ag-Cs and Sb-Cs Photoelectric Surfaces by G. Lewin—87-23: Electromotive-Force Measurements of Molten Binary Alloys by Ralph A. Schaefer and Frank Hovorka.—87-24: Study of the Effects of Gas Impurities in Fluorescent Lamps by Carl Kenty and Jeanette R. Cooper.—87-25: Some Physical Properties of Fluorescent Lamp Coatings by Richard N. Thayer.

Harvard University—Graduate School of Engineering: Publication:-
No. 401: Grounding Principles and Practice; I. Fundamental Considerations on Ground Currents by Reinhold Rudenberg (Reprinted from Electrical Engineering, Jan. 1945).—No. 402: Ends and Means of Soil Mechanics by Karl Terzaghi. Soil Mechanics Series No. 24. (Reprinted from The Engineering Journal, December 1944).—No. 403: Use of Frequency-Conversion Diagrams by Harry Stockman. (Reprinted from Proceedings of the Institute of Radio Engineers, November, 1944). UHF ConverterAnalysis by Harry Stockman. (Reprinted from Electronics, February 1945).—No. 404: Destruction of Water-Borne Cysts of Entamoeba Histolytica by Synthetic Detergents by Gordon M. Fair, Shih Lu Chang, Margery P. Taylor and Margaret A. Wineman. (Reprinted from American Journal of Public Health, March 1945). Applicability of Oxidation Potential Measurements in Determining the Concentration of Germicidally Active Chlorine in Water by Shih Lu Chang. (Reprinted from the New England Water Works Association, Journal, March 1945).

National Research Council of Canada:
Bibliography on Soil Mechanics, 1940-1944 by R. Ruedy. (N.R.C. No. 1291).

(Permanent Council of American Associations of Commerce and Production)
Consejo Permanente de Asociaciones Americanas de Comercio Y Produccion: La Conferencia de Montecideo Y El Cumplimiento de Sus Recomendaciones, 1941-1944.

Quebec—Department of Mines—Division of Geological Surveys:
Preliminary Report on the Bouthillier Map—Area, Labelle and Gatineau Counties by E. Aubert de la Rue. (in French and English). P. R. 187.—North Shore of the Saint Lawrence Aguanish to Washicoutai Bay by Jacques Claveau. (in French and English). P. R. 188.

United States—Geological Survey:
Publications of the Geological Survey (not including Topographical Maps), October 1944.

Geological Survey Bulletin:-
No. 924: Supplement of Catalogue of Mesozoic and Cenozoic Plants of North America, 1919-1937.—No. 935-D: Tungsten Deposits Isla de Pinos, Cuba.—No. 935-E: Nickel-Silicate and Associated Nickel-Cobalt-Manganese-Oxide Deposits near Sao Jose Do Tocantins, Goiaz, Brazil.—No. 935-F: Manganese Deposits in part of the Sierra Maestra, Cuba.—No. 935-G: Geology and Manganese Deposits of Guisa-Los Negros Area Oriente Province, Cuba.—No. 936: Strategic Minerals Investigation, 1942, Part 1, A-1; Short papers and preliminary reports by T. L. Kesler, W. H. Monroe, David Gallagher, and others.—No. 936-R Manganese Deposits in the Artillery Mountains Region, Mohave County, Arizona.—No. 937: Bibliography of North American Geology, 1929-39, Part 1. Bibliography.—Part 2. Index.—No. 940-G: Manganese Deposits of the Sweet Springs District, West Virginia and Virginia.—No. 940-H: Manganese Deposits of the Flat Top and Round Mountain Districts, Bland and Giles Counties, Virginia.—No. 940-I: Tungsten Deposits in the Boriana District and the Aquarius Range, Mohave County, Arizona.—No. 940-J: Cobalt-Bearing Manganese Deposits of Alabama, Georgia, and Tennessee.—No. 942: Geological and Geophysical Survey of Fluorspar Areas in Hardin County, Illinois; Part 1. Geology of the Cave in Rock District; Part 2. An Exploratory Study of Faults in the Cave in Rock and Rosiclare Districts by the Earth-Resestivity Method.—No. 944-A: Phosphate Deposits of the Teton Basin Area, Idaho and Wyoming.— No. 945-A: Geology of the Grey Eagle and some nearby Chromite Deposits in Glenn County, California.—No. 945-B: Chromite Deposits near San Luis Obispo, San Luis Obispo County, California.—No. 945-C: Beryllium and Tungsten Deposits of the Iron Mountain District, Sierra and Socorro Counties, New Mexico.

Geological Survey Professional Paper:-
No. 142-G: Molluscan Fauna of the Alum Bluff Group of Florida, Part 7. Stenoglossa (in part).—No. 204: Geology of the Hanover-York District, Pennsylvania.

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.

Geological Survey Water-Supply Paper:-

866-B: Geology of Dam Sites on the Upper Tributaries of the Columbia River in Idaho and Montana.—Part 2. Hungry Horse Dam and Reservoir Site, South Fork Flathead River, Flathead County, Montana.—889-C: Ground-Water Resources of the Houston District, Texas —889-D: Exploratory Water-Well Drilling in the Houston District, Texas —889-E: Chemical Character of Surface Waters of Georgia—913: Geology and Ground Water Resources of the Big Spring Area, Texas.—914: Texas Floods of 1938 and 1939.—918: Summary of Records of Surface Waters at Base Stations in Colorado River Basin, 1891—1938.—944: Water Levels and Artesian Pressure in Observation Wells in the United States in 1942; Part 1. Northeastern States.—945: Op. cit., Part 2. Southeastern States.—946: Op. cit., Part 3. North-Central States.—947: Op. cit., Part 4. South-Central States.—948: Op. cit., Part 5. Northwestern States.—950: Quality of Surface Waters of the United States, 1942 —951: Surface Water Supply of the United States, 1942; Part 1. North Atlantic Slope Basins.—952: Op. cit., Part 2. South Atlantic Slope and Eastern Gulf of Mexico Basins.—953: Op. cit. Part 3. Ohio River Basin.—955: Op. cit., Part 5. Hudson Bay and Upper Mississippi River Basins.—956: Op. cit., Part 6. Missouri River Basin.—962: Op. cit., Part 12. Pacific Slope Basins in Washington and Upper Columbia River Basin.—963: Op. cit., Part 13. Snake River Basin.— 974: Surface Water Supply of the United States, 1943; Part 4. St. Lawrence River Basin.—977: Op. cit., Part 7. Lower Mississippi River Basin.—978: Op. cit., Part 8. Western Gulf of Mexico Basins.—979: Op. cit., Part 9. Colorado River Basin.—981: Op. cit., Part 11. Pacific Slope Basins in California.—984: Op. cit., Part 14. Pacific Slope Basins in Oregon and Lower Columbia River Basin.

PAMPHLETS

Aspects of Electricity as an Economic Factor:

George B. Bessat. (Text of an address given by the author under the auspices of the Argentine Association of Electrical Technicians, 30th of November, 1944. Reprinted from Revista Electrotecnica, January 1945, v 31. In Spanish).

B—A Water Treatment:

Bird—Archer Co. Ltd., Montreal.

Modern Direct-Hydraulic System:

F. H. Towler. Institution of Mechanical Engineers, London, 1945. (Advance copy of Paper to be read at the Extra General Meeting, May 11th, 1945).

Postwar Employment and the Removal of Wartime Controls:

Research Committee of the Committee for Economic Development, N. Y., 1945.

Report to the Royal Commission on the Taxation of Co-operatives:

John L. McDougall. North-West Line Elevators Association, 1945.

Standard Filing System and Alphabetical Index;

For Filing Information.

Building Materials, Appliances, Equipment:

American Institute of Architects, Wash., 1942.

Strength of Magnesium Alloy Columns:

F. A. Rappleyea. Institute of Aeronautical Sciences, 1944.

BOOK NOTES

[Prepared by the Library of The Engineering Institute of Canada

COMMERCIAL METHODS OF ANALYSIS

Foster Dee Snell, and Frank M. Biffen. McGraw-Hill Book Co., New York; Embassy Book Co. Ltd., Toronto, 1944. 753 pp., illus., 8½ x 5½ in., buckram, $6.00.

This manual is a collection of methods of analysis for use in evaluating the many complex products found in commerce, concisely and accurately covering hundreds of determinations, and preserving the practical, economic approach warranted in commercial work. It offers a sound groundwork, and also describes specific procedures covering a wide range of determinations. Explanation of the reasons behind many of the methods, both in regard to procedures and also the derivation of results, is given.

Procedures described include standard methods of analysis of engineering societies, such as the American Society for Testing Materials and the Association of Official Agricultural Chemists, often with simplifications of these and special short methods. Numerous illustrations and a twenty page index increase the value and use of the book.

ELECTRIC POWER DISTRIBUTION FOR INDUSTRIAL PLANTS

Developed by the A.I.E.E. Committee on Industrial Power Applications. American Institute of Electrical Engineers, New York, 1945. 109 pp., illus., 10¾ x 7¾ in., paper, $1.00.

This report is intended to outline sound engineering principles of distributing power in industrial establishments. The report, within its scope, analyzes the service requirements, voltage regulation problems, load characteristics and distribution system characteristics, and it also deals wth the selection of equipment for distribution systems. Operating and maintenance problems are dealt with only insofar as they affect system and equipment selection.

NATIONAL FIRE CODES FOR FLAMMABLE LIQUIDS, GASES, CHEMICALS AND EXPLOSIVES, 1945

National Fire Protection Association, 60 Batterymarch Street, Boston, Mass., 1945. 592 pp., illus., 6 x 9 in., cloth, $3.00.

This book assembles for the convenience of the reader the many standards dealing with fire hazards. Superseding the National Fire Codes for Flammable Liquids, Gases, Chemicals and Explosives for 1943, the new volume contains up-to-date information on new chemicals and solvents used in war industries, including information on their fire hazard properties and the best method of fire extinguishment. In addition, there are six new or revised codes.

The coverage is as follows: Flammable Liquid Storage and Handling; Oil and Gasoline Burning Equipment; Liquified Petroleum Gases; Utilization of Flammable Liquids; Gases; Refrigeration and Fumigation; Explosive and Nitrocellulose Materials; Tables of Properties—Hazardous Chemicals, Flammable Liquids; Flash Point Tests.

The codes are purely advisory as far as the N.F.P.A. is concerned, but are, however, widely used as a basis of law, as well as by property owners as a guide to good practice, and for insurance purposes. In preparing all standards the aim of the N.F.P.A. committees has been to specify measures that will provide reasonable fire safety without prohibitive expense, or undue inconvenience.

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 on PAPER and PAPER PRODUCTS

Prepared by A.S.T.M. Committee D-6 on Paper and Paper Products; Methods of Testing Specifications, December, 1944. American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., 1945. 182 pp., illus., diagrs., charts., tables, 9 x 6 in., paper, $1.50.

The second edition of this publication provides in their latest form, as of November, 1944, all of the 49 specifications, test methods, and related standards that have been developed through the work of the A.S.T.M. committees on paper and paper products. The wide coverage includes laminated sheets, vulcanized material for electrical insulation, adhesiveness of gummed tape, flammability, etc., as well as the more directly related subjects.

AEROPLANE PRODUCTION YEAR BOOK and MANUAL (II) 1944

Edited by M. M. Williamson and G. W. Williamson, introduction by Sir R. H. Dobson. Paul Elek (Publishers) Ltd., Africa House Kingsway, London, W. C. 2, England, 1945. 573 pp., illus., diagrs., charts, tables, 8½ x5½ in., cloth, 40s.

This continuation of a series covering aircraft production processes deals mainly with heavy bombers and the transaction to civil aircraft. Part I contains several articles on various phases of air transport and the aircraft industry. The rest of the book describes equipment and processes under the following headings: materials of aircraft production; specialized airframe processes; airframe tools; testing equipment; production of complete aircraft; installation and equipment; and ground equipment. British practice only is considered, and the descriptions are of products of specific British manufacturers. The volume is well indexed.

ANALYSIS of FOODS

By A. L. Winton and K. B. Winton. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 999 pp., illus., diagrs., charts, tables, 9 x 6 in., cloth, $12.00.

This is an encyclopaedia of methods of food analysis, compiled by two analysts of long experience. Over 1000 methods are listed, with ample bibliographies and with working directions for many. The first portion of the book is devoted to general methods of analysis, microscopic, physical and chemical. The second part describes the special methods used for cereals, dairy products, animal foods and other varieties.

ARC WELDING ENGINEERING and PRODUCTION CONTROL

By W. J. Brooking. McGraw-Hill Book Co., 1944. 347 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $4.00.

This manual covers the arc welding process as applied in manufacturing and fabrication, based largely on typical industrial experience. It discusses the significance of materials, fixtures, engineering control, process planning and organization, and shows how to analyze these and other factors as a basis for the effective application of arc welding to specific manufacturing problems. A final chapter gives sources of information on welding problems.

Chemistry of ACETYLENE. (A.C.S. Monograph Series No. 99).

By J. A. Nieuwland and R. R. Vogt. Reinhold Publishing Corp., New York, 1945. 219 pp., diagrs., tables, 9½ x 6 in., cloth, $4.00.

A brief but fairly complete account is given of the preparation, properties and reactions of acetylene. The scope of the book is well illustrated by the section headings: physical properties, preparation and purification; metallo-derivatives; substitution of non-metal atoms or radicals for the hydrogen of acetylene; addition of non-metallic elements and compounds to acetylene; polymerization of acetylene and condensation with carbon compounds. The customary extensive classified bibliography associated with the books in this series is included.

DAMPING CAPACITY: a General Survey of Existing Information. (Association Series No. 657)

By F. C. Thompson. British Non-Ferrous Metals Research Association, Euston Street, London, N.W.1, 1944. 37 pp., diagrs. charts, tables, 9¾ x 6 in., paper, 3s. 6d.

This survey of the damping capacity of metals and alloys deals with such matters as the significance of damping capacity from the metallurgical and the engineering points of view, the directions in which quantitative information is lacking and needed, the nature of experimental investigations likely to give results of practical value, and the validity of present methods of determining damping capacity. A bibliography is included.

DISCOVERY of the ELEMENTS

By M. E. Weeks. 5th ed. enlarged & revised. Journal of Chemical Education, Easton, Pa., 1945. 578 pp., illus., charts, tables, 9½ x 6 in., cloth, $4.00.

The story of the discovery of the elements, from the nine known to the ancient world to the ninety-four now known is a long one to which many men have contributed. It is told here with clarity and much human interest, and accompanied by many photographs of those who contributed to the search, and by much biographical information. The book will interest not only young chemists but also students of chemical history.

INDUSTRIAL ELECTRICAL FURNACES and APPLIANCES, Vol. 1

By V. Paschkis. Interscience Publishers, New York, 1945.232 pp. illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.90.

The first section of this practical book covers generally the thermal, electric and economic principles applying to all types of furnaces and appliances. The second section discusses arc furnaces and electrode melting furnaces, with special attention to ferro-alloy furnaces. Special emphasis is placed on the thermal aspects of furnace design and operation, and design principles are discussed in detail. A second volume will deal with induction capacitance, and resistance heating.

INTERNATIONAL RIVER and CANAL TRANSPORT. (International Transport and Communications)

By Sir O. Mance. Oxford University Press, London, New York and Toronto, 1945. 115 pp., tables, maps, 8½ x 5½ in., paper $1.00.

This study deals first with matters of legal regulation and administration that might affect waterways all over the world. It then examines in some detail the general situation and specific problems of each continent. Finally suggestions are made respecting the future political control and technical development of waterways in so far as international transport and the commercial organization of waterways traffic are concerned.

MACHINE DRAWING, a Text and Problem Book for Technical Students and Draftsmen

By C. L. Svensen. 3 ed. D. Van Nostrand, New York, 1945. 280 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $2.50.

Machine drawings are defined in this book as the result of the practical application of mechanical drawing to the representation and specification of machinery. On this basis a brief discussion of elementary principles is followed by chapters dealing with various classes of machine elements and such topics as welded and riveted construction and piping drawings. Dimensioning and machine sketching are covered in detail, and the last hundred pages are devoted to a wide variety of problems and studies.

MANUAL of FIREMANSHIP, Pt. 7. Fireboats and Ship Fires

Published by His Majesty's Stationery Office, London, 1944. 149 pp., illus., diagrs., tables, 8½ x 5½ in., paper, 2s. 6d. (Obtainable from British Information Services, 30 Rockefeller Plaza, New York, $.75).

The series of which this is a part constitutes a general survey of the science of firefighting. Part 7 contains descriptive material on fireboats and their equipment, instructions in seamanship, firemanship and control in fireboat formations, and discusses fires in ships both with respect to their nature and to the methods to be used in fighting them.

PLANNING for POSTWAR MUNICIPAL SERVICES

International City Managers' Association, Chicago, 1945. 90 pp., 10 x 6¾ in., paper, $2.00.

The sixteen chapters by leading authorities in various fields of municipal activity appeared originally in "Public Management". They outline the extent of municipal responsibility, anticipate postwar conditions and needs, indicate services that may be expanded, abandoned, or transferred to other units, and outline methods of making plans. Each chapter contains a brief list of selected references to other literature on the subject.

PLASTICS CATALOG, The 1945 Encyclopedia of Plastics

Plastics Catalogue Corp., 122 East 42nd St., New York, 1945. 1178 pp., illus., diagrs., charts, tables, 11½ x 8¼ in., cloth, $6.00.

This compendium of information on plastics covers a wide field and should be useful to every present or prospective user. Recent progress in the field is reviewed. Methods of identifying and testing plastics are described. The varieties are discussed at length and their qualities considered. Other sections deal with Engineering Design for Plastics; Methods of Molding, Extruding and Casting; Fabricating, Finishing and Assembling; Machinery; Laminates, Plywood and Vulcanized Fiber; Coating; Synthetic Fibers; Rubberlike Plastics. A large store of useful tabulated data is included.

PRECISION MEASUREMENT in the METAL WORKING INDUSTRY Vol. 2

Prepared by the Department of Education of International Business Machines Corporation, publ. by Syracuse University Press, Syracuse, New York, 1944. 290 pp., illus., diagrs., charts, tables, 11 x 8 in., cloth, $4.75.

This volume covers the more advanced types of precision measuring instruments and machines used in manufacture. Chapters on Surface plates, Angles, Comparison measurement, Optical instruments, Measuring machines, Surface roughness, and Hardness testing are included. The various instruments are described and instruction given in their use. The course is based on practical shop work and is a very definite one.

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

June 25th, 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 August 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 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

BARRETT—LESLIE JAMES, of Three Rivers, Que. Born at Hawera, New Zealand, Feb. 4th, 1901. Educ.: Diploma 1919, Wellington Tech. Coll.; chartered apticeship. as follows: 1917-19, H. A. Smith & Co., 1919-21, Union S S Co , Wellington; 1921-22 i/c elec. power plant R.M.S. Marama; 1922-26, with Shawinigan Water & Power Co. as follows: electrician on constrn.; power house operator at Shawinigan Falls; 1926-27 foreman on constructn. with Canadian Comstock Co., East Templeton, Que. on erection of Can. Int. Paper Co.'s plant; 1927-28, foreman i/c power installn., Can. Westinghouse Co., Ottawa; 1928-29, elec. dftsman., Shawinigan Water & Power Co., Shawinigan Falls; 1929-33, meter dept., chief, Beauharnois Elec. Co., Valleyfield; 1935-37, operator, Harland Paper Machine Drives, Price Bros. Co., Riverbend, Que.; 1937-39, meter engine and electric drive trouble investigation, Consolidated Paper Co.; 1939-40, power house operator, Shawinigan Water & Power Co.; 1940 to date, elec. supt., Electric Steels Limited, Cap de la Madeleine, Que.

References: J. A. McCrory, K. W. Fraser, H. J. Ward, A. S. Poe, E. V. Leipoldt.

BELL—NORMAN, of Arvida, Que. Born at Calgary, Alta., April 16th, 1916. Educ.: B.A.Sc. (Chem. Eng.), Univ. of B. C., 1937, M.S. (Chem. Eng.), Univ. of Mich., 1939; 1937-38, chemical assayer, Cons. Mining & Smelting Co., Ltd., Trail, B. C.; with the Aluminum Co. of Canada as follows: 1939-42, chemical engr. & supvr., Bayer Ore Plant No. 1, 1942 to date, asst. supt., Bayer Ore Plant No. 2.

References: G. A. Antenbring, P. E. Radley, D. D. Reeve, M. G. Saunders, F. T. Boutilier.

BLOCK—FRANK, of 239 Brock Ave., N., Montreal West, Que. Born at Baden nr. Vienna, Austria, Sept. 3rd, 1896 (naturalized Canadian.) Educ.: grad. mech. engr., Technical Univ. in Vienna, 1921, government authorized consultg. engr., Vienna; 1914-16 & 1918-21, (summers,) workshop practice; 1921-38, with Maschinen & Waggon B. Fabr. A.G. in Simmering as follows: designer, chief engr. of boiler dept.; with Dominion Bridge Co., Ltd., Lachine, as designer, 1938-40, boiler dept., 1940-42, mech. dept., 1942, to date, boiler dept.

References: R. S. Eadie, A. S. Wall, R. H. Finlay, C. D. Bailey, C. E. Bedford-Jones, G. N. Martin.

BOWDEN—HENRY JOSEPH of Arvida, Que. Born at Wingham, Ont., May 2nd, 1918. Educ.: B.Eng. (Chem.), Univ. of Detroit, 1940, (accredited E.C.P.D.); 1939-43, chief chemist i/c production control, C. E. Jamieson & Co., Windsor; 1943 to date with Abrasives Co. of Can., Arvida, as chief chemist i/c of research and control lab., and chem. engr. assisting in control of plant operations.

References: W. J. Thomson, R. Marcotte, H. R. Fee, F. T. Boutilier.

BRAUN—JOHN FRIDOLIN, of Arvida, Que. Born at Wil (St. Gallen) Switzerland, Dec. 3rd, 1899. Educ.: scientific engrg. study, Ecole Polytechnique, Zurich, 1917-22, 1922-24; Bureau d'Etudes Tech., Bruxelles, Belgium; 1924-25, Wayss & Freytag, Cologne, Germany; 1925-28, Standard Portland Cement Co., Sydney, Australia; 1928-29, A. S. Macdonald, A.R.J.C., B.Sc., Sydney, Australia; 1929-31, Ross & Macdonald, Montreal; 1935-45, Aluminum Co. of Can., Ltd., Arvida, Que., supt. i/c of Bauxite refining plants at Arvida.

References: McN. DuBose, R. H. Rimmer, P. E. Radley, M. G. Saunders, C. Miller, G. M. Mason, F. T. Boutilier, C. G. Kemp.

BURKE—LESLIE ARCHIBALD, of 134 Farady Street, Ottawa, Ont. Born at Newcastle-on-Tyne, England, Nov. 29th, 1914. Educ.: Bellahouston Academy to 4th yr.; 1930-35, apticeship. with Atlas Polar Diesel Engine Co., Glasgow, qualified engr. employed as machine-shop and assembly insptr.; 1936 asst. to chief insptr. of Harland & Wolfe, Finnieston, Glasgow, responsible for design and approval all gauges, and for inspection all details and final products; 1937, chief insptr. of Armaments' Staff, as examiner of armaments in Royal Arsenal, Woolwich, England, engaged on inspection of all types guns and carriages, etc. in Royal Ordnance and civilian factories; 1939-40, asst. supvr. armament inspectn. Glasgow Area; 1940, on loan from Ministry of Supply to British Technical Mission, Canada (Inspection Board of the U. K. & Can.); 1940, Otis-Fensom Elevator Co., Hamilton, chief examiner guns and carriages, Canada, asst. to chief inspectng. officer of Inspection Board of U. K. & Canada; 1943 to date, with Dept. National Defence as follows: mech. inspectn. artillery throughout Canada, and subsequently as artillery specialist with Dir. of Mech. Engrg., M.G.O., N.D.H.Q. (Army), Ottawa.

References: H. G. Thompson, E. C. Mayhew, H. O. Monk, Les. Brodie, H. P. Cadario.

CAREY—MALCOLM L., of Arvida, Que. Born at Lincoln, N. H., Mar. 3rd, 1900. Educ.: S.B., Mass. Inst. Tech., 1925; 1925-26, tech. asst., Aluminum Co. of America, Massena, N. Y.; with Aluminum Co. of Can., as follows: 1926-30, tech. asst., Arvida; asst. supt., Shawinigan Falls; 1933-37, work in nickel and copper industry, Int. Nickel Co., Copper Cliff, Ont.; with Aluminum Co. of Can., as follows: 1937-38, asst. supt., 1938-42, supt., Arvida, 1942 to date, genl. prod. supt., i/c all products including alumina, aluminum, carbon electrodes, fluoride salts, alum, aluminum paint, etc.

References: A. C. Johnston, M. G. Saunders, C. Miller, P. E. Radley, R. H. Rimmer.

COMACH—STANLEY IRVING, of Ottawa, Ont. Born at Georgetown, British Guiana, July 16th, 1905. Educ.: corr. course in engrg., private tuition; 1922-27, apticeship, Naval Radio Stn. BZL, British Guiana; subsequently installng. stations 1½ to 5 KW in jungle of B. G. for British Gov't.; 1928-39 with Research Products, later Dominion Sound Equipt., Ltd., on installns., mtce. sound reprod. equipt., W/T. gear (shipborne), P. A. work supvr., broadcast church services for CKAC and later CBM; 1936-40, dist. supvr., i/c Quebec and eastern Ontario; 1940 to date, with R.C.N.V.R. as follows: Lieut. assigned to assist. Cmdr. F.W.R.Angus in organizing production anti-submarine equipt. in Canada; responsible for production engrg. and inspn., work finally evolved into Directorate of Electrical Supply; promoted to Elect. Cmdr. in 1944; now Deputy Director of Elect. Supply, Naval Service, Dept. National Defence, Ottawa, Ont.

References: F. W. R. Angus, A. D. Turnbull, Guy Eon, A. C. M. Davy, T. Durley, G. L. Stephens.

CORMAN—WILLIAM E., of Toronto, Ont. Born at Stoney Creek, Ont., July 30th, 1886. Educ.: Mech. Engr. (Toronto Univ.), 1909; R. P. E., Ont.; 1909-10, constrn. work; 1910-14, C. H. & P. H. Mitchell, consultg. engrs.; 1914-19, plant engr., Excelsior Electric Co.; 1919-45, started own business, Corman Engrg. Ltd., i/c drafting room and mech. design, i/c general machine shop and tool room, directs all mechanical design in connection with present business, drafting room, design dept., for special machinery of every description.

References: H. E. T. Haultain, R. W. Angus, E. A. Allcut, H. A. Cooch, L. T. Rutledge, F. R. Ewart, A. D. LePan, R. L. Dobbin, W. P. Dobson, O. Holden, T. H. Hogg, W. D. Black.

DAGG—FRANK ANDERSON, of Isle Maligne, Que. Born at Holland, Man., Aug. 31st, 1907. Educ.: B. Sc. (Civil), Univ. of Man., 1929; R. P. E., Man.; 1927, (summer), drafting dept., Highways, Ontario; 1928, (summer), concrete design Winnipeg City Hydro; 1930 (6 mos.), steel foreman, Stuart & Grant; 1931, bridge design, Manitoba Good Roads; 1935, constrn. engr., Kanuchuan Power Co.; 1936-39, dist. engr., P.F.R.A.; 1940-41, constrn. engr., Ducks Unlimited, Winnipeg; with Aluminum Co. of Can., as follows: 1942-44, concrete design and detail (6 mos.), constrn. engr., (18 mos.), 1944 to date, supt., atomizing plant, Isle Maligne, Que.

References: A. E. Macdonald, C. H. Attwood, G. R. Fanset, D. M. Stephens, D. G. Elliot, V. J. Melsted.

FINLAY—WENDELL IRVING, of 1245 (25) Nelson St., Vancouver, B. C. Born at Centralia, Ont., Oct. 12th, 1918. Educ.: B.S., M.E., Detroit Inst. Tech. (not accredited E.C.P.D.), 1940; 1940, (summer), aircraft inspn., National Steel Car, Malton, Ont.; with Sutton Horsley Co., Toronto, as follows: 1940-41, engrg. dept. and pur., 1941-42, prod. engr. and assembly supt., 1942-45, i/c procurement of equipt., materials, sub-contractg., etc.; and at present, mgr. pur. dept., Neon Products of Western Canada, Vancouver, B. C.
References: T. O. Watts.

GIBSON—DESMOND HOPE, Major, R.C.E., of Hamilton, Ont. Born at Hamilton, Ont., Jan. 5th, 1920. Educ.: Grad. R.M.C., Kingston, 1939; 1939-44, with R.E. and R.C.E., in U. K., North Africa, Sicily, Italy and N. W. Europe; at present engr. with Canadian Military Mission, Washington, D. C.
References: H. A. Lumsden, E. G. Mackay, F. I. Ker, H. J. A. Chambers.

GURNEY—EDWARD HOLT, of Toronto, Ont. Born at Toronto, Ont. on Aug. 25th, 1882. Educ.: 1900-01, School of Practical Science, Toronto; With Gurney Foundry Co., Ltd., Toronto, as follows: 1904-12, engaged on heating layouts and plant design; 1919 to date, president; 1917-18, director, Marine Machinery Supply, Imperial Munitions Board; 1940 to date, president, Electric Steels Ltd., Cap de la Madeleine, (who built and operate a government and machine shop).
References: L. A. Wright, J. M. R. Fairbairn, J. G. Notman, T. H. Hogg, R. E. Chadwick, H. H. Angus.

HALL—CHARLES, of 211 Pretoria Ave., Ottawa, Ont. Born at Leeds, Yorkshire, England, Jan. 17th, 1900. Educ.: Diploma machine drawing, Toronto Tech. School, 1932; 1916-21, apticeship. G. Marr Co., Leeds; 1921-40, with W. D. Beath Co., Toronto, as follows: foreman in Toronto shop, later in engrg. dept. on design and bldg. of dry cleaning mchny., solvent systems, hydraulic pumps, development of snow plows, etc.; at outbreak of war assigned to British Tech. Mission to develop materials inspection section of Board; on various assignments in Canada and U. S. A.; at present Equipment & Tool Controller at plant of Ottawa Car & Aircraft Ltd.
References: E. G. Patterson, W. R. Peck, J. M. Carswell, W. H. G. Flay.

HARRINGTON—JOHN METCALFE, of Arvida, Que. Born at Montreal, Que., July 2nd, 1913. Educ.: B.Sc. (Chem.), McGill Univ., 1935; 1936-39, chemical research on engrg. problems with Can. Industries Ltd., Toronto Ont.; 1939-42, Fraser Companies, Edmundston, N. B.; at present, research chemist with Aluminum Co. of Can., Ltd., Arvida, Que.
References: G. M. Mason, J. E. Pepall, G. A. Antenbring, J. T. Nichols D. F. Nasmith.

HENRY—ALBERT AUSTIN, S/Lieut., R.C.N.V.R., North Vancouver, B. C. Born at Marengo, Sask. July 8th, 1917. Educ.: 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); with B. C. Pulp & Paper Co., Ltd., Port Alice, B. C. as follows: 1935-38, electrn., 1938-40, i/c shift operation of 2000 & 3000 K.W. turbo generators & switchboard, genl. mtce., repair, instln. of plant elect. equipt.; 1941 to date, Electrical Overseer, Halifax Shipyards. Ltd., Halifax, N. S.
References: F. H. Sexton, G. H. Burchill, J. Deane, J. J. Smith, C. C. Ryan.

HOBNER—ROBERT HENRY, of Jean Brillant, Que. Born at Leicester, England, Sept. 7th, 1910. Educ.: B.Sc. (Elec.), Univ. of Man., 1935; 1930-35, Manitoba Forest Service; 1936-37, Canadian Fairbanks Morse Co., Winnipeg; 1938-39, demonstrator electrical engrg., Univ. of Toronto; with D.I.L.,Bouchard Works (as follows: 1939-41, elect. engr., 1941-42, elect. field engr., responsible to res. engr. for entire electrical installn.; 1942-44, elect. supt., responsible for electrical mtce., operations and constrn., 1944, (2 mos.), chief design engr., responsible for plant's engrg. dept., 1944 to present, supt. of mtce., responsible for mtce. of entire plant, including electrical.
References: J. G. Walsh, H. C. Karn, J. R. Auld, C. F. Davison, E. P. Fetherstonhaugh, G. E. Griffiths, A. T. Hurter, M. S. MacGillivray, D. A. Killam, D. Anderson.

JAMIESON—EDGAR ARCHIBALD, Lieut. Cmdr. (SB) (E), of 3643 West First Ave., Vancouver, B. C. Born at Pakenham, Ont., Mar. 31st, 1888 Educ.: Mech. & Elect. Engr., Univ. of Tor., 1910, R.P.E., B. C.; with C.P.R. as follows: 1910, rly. survey and constrn. in B. C., 1911-12, asst. engr. in B. C., 1913-15, divn. engr., water rights branch, Vancouver Divn.; 1915-19, military duty, inspector, guns and steel, G. B., U. S. A. and Can.; 1919-39, private practice in Vancouver, investigation of power sites and reports, steam power plants, surveys: irrigation, topographical, road and constrn., bridge work, mining operations, installn. of machinery, etc., power, pulp and paper; 1939 to date, Asst. Inspector and Sr. Inspector of Guns, at present, Inspector of Naval Ordnance, Special Branch, R.C.N.V.R., Vancouver, B. C.
References: J. B. Challies, L. A. Wright, W. G. Swan, J. A. Walker, A. D. Creer, P. H. Buchan, A. C. R. Yuill, E. A. Cleveland.

MacDONALD—FRANK SANBORN, of 201 Fourth Ave., Ottawa, Ont. Born at North Sydney, N. S., June 26th, 1902. Educ.: B.Sc. (Mech. Eng.), N. S. Tech. Coll., 1925; 1922-23, mach. tool operator, Dominion Iron & Steel Co., Sydney, N. S.; 1925-26, (9 mos.), asst. to master mechanic, Nfld. Pulp & Paper Co., Nfld.; 1926, (9 mos.), mech. dftsman., Stone & Webster Co., Boston, 1926-27, heat. and vent. engr., French & Hubbard, Boston; 1927-28, mech. dftsman, Solvay Process Co., Syracuse; 1928-30, mech. engr., Dryden Paper Co., Dryden, Ont.; 1930-37, chief dftsman, Spruce Falls Pulp & Paper Co., Kapuskasing, Ont.; with J. R. Booth Ltd., Ottawa, as follows; 1937-41, plant engr., 1941 to present, prod. mgr., Booth Mill, E. B. Eddy Co., Hull, Que.
References: T. Foulkes, H. D. Hyman, C. W. Boast.

MacINTYRE—THOMAS MOODIE, of Renfrew, Ont. Born at Renfrew, Ont., Aug. 7th, 1895. Educ.: B.Sc. (Civil), Queen's Univ., 1920; 1920-21, layout work, Montreal Tramways; 1921-22, instrumn., Dept. of Public Highways; with James Bay R. R. Ext., as follows: 1922, dftsman and office engr., 1922-23, transitman on location, 1923-24, res. engr., constrn., instrumn,; levelman, Kapuskasing-Smoky Falls R. R., (3 mos.); asst. res. engr., Nipissing Central R. R., (4 mos.); res. engr., Abitibi Pulp & Paper Co., transmission line constrn.; with Fraser Brace Co., as follows: 1925-27, layout engr., power house constrn., 1927-28, i/c transmission line constrn., 1928-30, field engr., on constrn.power plant; 1930-31, res. engr., Moose River Bridge, T. & N. O. Rly.; 1931-32, constrn. engr., 1936-37, township engr., Township of Teck (Kirkland Lake); 1937-38, supt., road constrn., King Paving Co.; 1938-39, supt. on various projects, McNamara Constrn. Co.; with Fraser Brace Co. as follows: 1940, field engr., i/c cordite plant, Nobel, Ont., 1941 materials engr., Transcona, Man., cordite plant; 1941-43, asst. res. engr., Shipshaw Power Development; 1943-44, res. engr., diversion work at Steep Rock Iron Mines; 1944, i/c survey, Peticodiac Tidal Survey; 1944-45, with H. G. Acres & Co., as follows: res. engr., power plant constrn. at Espanola, Ont., and at present field engr. on survey of hydro-electric power installn., British Columbia Power Commission Victoria, B. C.
References: H. G. Acres, A. W. F. McQueen, C. Miller, J. H. Ings, P. C. Kirkpatrick.

McGEE—RICHARD ORVILLE, of 24 Alexander St., Ottawa, Ont. Born at Ottawa, Ont., Sept. 23rd, 1909. Educ.: B.Sc. (Met. Eng.), Queen's Univ., 1932; 1930, (summer), Dept. Mines & Resources, Geological Survey: 1932-34, genl. smelter work, Noranda Gold Mines Ltd., 1934-35, assayer & engr., Dik-Dik Gold Mines; 1936-41, examiner of metall. inventions, Can. Patent Office; 1941 to date, inspecting officer, responsible for metall. inspecn. ordnance equipt., administr. and personnel of materials divn., Inspection Board of the U. K. and Canada, Ottawa, Ont.
References: H. F. Crain, A. A. Young, A. E. MacRae, R. C. Simon, T. O. Whillans, D. S. Ellis.

McKEOWN—RAYMOND JOHN, Lieut. Cmdr. (E), R.C.N.V.R., of 486 Mountain Ave., Westmount, Que. Born at Victoria, B. C., Oct. 3rd, 1916. Educ.: B.Sc. (Met. Eng.), Queen's Univ., 1941, R.P.E., Ont.; 1936, (5 mos.), Algoma Steel Corp.; 1939, (5 mos.), Int. Nickel Co. of Can., Copper Cliff, Ont.; 1940, (5 mos.), Kelowna Exploration Co., Hedley, B. C.; with Naval Service as follows: 1941-43, Watchkeeping Engr. Officer, full responsibility of main propelling & auxil. mchnry. & personnel; 1943-44, Chief Engr., i/c mchnry. and engine room dept., H.M.C. Destroyer Niagara; 1944, (4 mos.), Engr. Officer, H.M.C.S. Stadacona; and at present Staff Officer, Engr. Personnel, Canadian Naval Mission Overseas, 10 Haymarket, London, S. W. I, England.
References: F. L. Thompson, J. R. Reynolds, S. F. Rutherford, O. Bush, S. Phillips, W. H. G. Roger.

NARGANG—JOHN WALTER, of Saguenay Inn, Arvida, Que. Born at Regina, Sask., Aug. 24th, 1916. Educ.: B.Sc. (Mech.), Univ. of Sask., 1943; 1943; (4 mos.), contrn. work concerned mostly with installn. mill equipt.; and to date, mtce. engr., Aliminum Co. of Canada, Arvida, Que.

References: I. M. Fraser, N. B. Hutcheon, M. G. Saunders, J. T. Nichols, F. T. Boutilier.

OLIVER—HARRY ALFRED, of 1233 King St., W., Hamilton, Ont. Born at Hamilton, Ont., Dec. 20th, 1902. Educ.: corr. courses and tech. school (night classes); 1918-25, jr. structl. dftsman., Hamilton Bridge Co., Hamilton; 1925-26, structl. dftsman., Jones & Laughlin, Pittsburgh, Pa.; 1926-27, detailing and checking (structl.), J. E. Moss Iron Works, Wheeling, Va.; 1927-28, structl. designer, coal and coke handling equipt., Koppers Constrn. Co., Pittsburgh, Pa.; with Hamilton Bridge Co. as follows: 1928-41, structl. checker and i/c of work, 1941-43, asst. development engr., (armour car development), 1943-44, structl. designer; and at present, squad leader (structl.) dfting. office.
References: W. S. Macnamara, W. B. Nicol, N. M. Wagner, J. A. W. Brown, L. Grime.

SHELDRICK—KENNETH DOUGLAS, Captain, R.C.E.M.E., of Lachine Que. Born at Kingston, N. B., Oct. 19th, 1907. Educ.: B.A. (specialization in science), Univ. of N. B., 1927, course at Military Coll. of Science, England, 1943; 1927-29, asst. in mill control dept., Nashwask Pulp & Paper Co., Ltd., Saint John, N. B.; 1930-32, service engr., design, installn., and adjustments of metering and automatic control layouts, Bailey Meter Co., Ltd., Montreal; with Directorate of Mech. Engrg., as follows: 1942-44, E.M.E., i/c Artillery Fire Control Instrument Section, 1944, (4 mos.), i/c Armament Group, 1944, proceeded overseas, (4 mos.), E.M.E. attached to Instructional Wing of No. 1 C.O.M.E. Reinforcing Unit, 1944-45, (4 mos.), E.M.E., i/c Machine Shop and later of Ancillary Shops at No. 1 Canadian Base Workshop, C.A.O.S., and at present attached to Chief Inspector of Armaments of the British Ministry of Supply, Woolwich, England.
References: H. G. Thompson, E. B. Wardle, P. E. Poitras.

SMITH—KENNETH ROLAND, of Hamilton, Ont. Born at Hamilton, Ont. Feb. 21st, 1905. Educ.: night classes, 1919-23; with Hamilton Bridge Co., as follows: 1919-21, structl. design course at Hamilton Tech., 1924-27, i/c small order dept., 1937-40, i/c as squad leader, drawing office, 1941 to date, i/c armoured car engrg. and development.
References: H. J. A. Chambers, W. B. Nicol, W. S. Macnamara, A. Love, L. Crosby, E. Barratt.

SORBY—WALTER OSWALD, Major, C.M.H.Q., 2 Cockspur St., London, Eng. Born at Gelph, Ont., Aug. 18th, 1901. Educ.: B.A.Sc., Univ. of Tor., 1925; with Westinghouse Elec. & Mfg. Co. and Canadian Westinghouse as follows: 1926-28, sales asst., Elmira, N. Y., 1928-30, correspondent, 1930-40, sales negr., Winnipeg office; 1944 to present, Technical Staff Officer (Artillery), Canadian Military H.Q., London, England.
References: C. P. Haltalin, E. V. Caton, L. M. Hovey, J. W. Sanger, H. L. Briggs.

STEEVES—CECIL MYRON, of Sao Paulo, Brazil. Born at Moncton, N. B., Dec. 16th, 1906. Educ.: B.Sc. (Elect.), Univ. of N. B., 1927, R.P.E., Ont.; 1926, student electrn., Aliumnum Co. of Canada, Arvida, Que.; 1927-28, student engrg. course, Can. Gen. Elec. Co., Peterboro, Ont.; 1928-38, asst. elec. engr., Canadian & General Finance Co., Ltd., Toronto, Ont., purchasing inspectn., consultg. engrg. work for company's properties in Brazil, Mexico and Spain; 1938 to date, with Sao Paulo Tramway, Light & Power Co., Ltd., Sao Paulo, Brazil, as follows: elect. engr., new constrn. office; responsible for electrical design and acceptance of generating stations, pumping stations and high tension transmission lines of Sao Paulo Tramway, Light & Power Co., Ltd., and The Rio de Janeiro Tramway, Light & Power Co., Ltd.
References: R. L. Dowling, A. Roberts, E. H. Hayes, W. M. Cruthers, J. Stephens.

WHEATON—ISAAC GILBERT, of Toronto, Ont. Born at Midgic, N. B., Dec. 27th, 1884. Educ.: B.Sc. (Civil), McGill Univ., 1907, R.P.E., Ont.; 1907, (6 mos.), foreman on concrete shop constrn., E. A. Wallberg Co.,; 1908, (6 mos.), steel erection, Dominion Bridge; 1908, (6 mos.), land surveying, G. K. Addie, Q. L. S.; with Int. Nickel Co. as follows: 1908-09, mine surveying; 1909-13, instrumn., mine surveying, mine surveyor; 1913-16, engr., mtce. smelter, Mond Nickel Company; 1916-19, mgr., Crews-McFarland Co., prospecting amd mine development; 1919, (6 mos.), engr., bldg. constrn., Consolidated Asbestos; with Imperial Oil Co., Ltd., as follows: 1919-23, engr., designing and drafting, 1923 to date, mgr. of constrn., design and bldg., general sales dept.
References: G. H. Crase, F. C. Mechin, C. E. Carson, L. Lee, K. D. McDonald.

WILSON—RONALD S., Lieut. (E), R.C.N.V.R., Born at Edmonton, Alta,. May 6th, 1920. Educ.: B.Eng. (Mech.), McGill Univ., 1943; 1940-41, (summers), Canadian National Railway; 1942, Canadian Vickers Ltd., Montreal; 1943 to date with R.C.N.V.R. as follows: engrg. responsibility aboard H.M. & H.M.C. Ships and at present Chief Engr. aboard H.M.C.S. St. Boniface, c/o F.M.O., Halifax, N. S.
References: A. R. Roberts, C. M. McKergow, G. H. Herriot, E. P. Fetherstonhaugh, J. W. Sanger.

YEOMAN—ALAN ROBERT ARCHIBALD, Elect. Lieut., R.C.N.V.R., of Halifax, N. S. Born at Auburn, N. S., June 7th, 1917. Educ.: 1st class cert., radio, Dept. of Transport; 1936-41, attended Johnson Radio School, subsequently employed as radio operator on seagoing and shore stations; 1941-42, Special Branch Officer, Sub. Lieut., R.C.N.V.R., making elect. installns. at Canadian Vickers, Burrard Drydock, North Vancouver, Ship Repairs Branch, Yarrows Limited, Victoria machine depot. etc., on R.C.N. ships; 1942-43, inspecting electrical installns. on H.M.C. ships and mtce. of operational ships at Quebec City, mtce. of sonic systems and installns. of same at H.M.C. Dockyard, Halifax; 1943-44, Officer i/c Gyro Compass Base, Halifax Dockyard; 1944 to date, Supervising Gyro Compass Officer, Atlantic Coast, including mtce. of special tactical navigational units.
References: J. E. Deane, G. V. Ross, M. A. Harrigan, F. W. R. Angus, H. F. Kent.

FOR TRANSFER FROM JUNIOR

BUCHANAN—ARNOLD AMHERST, W. C., R.C.A.F., of Camp Borden, Ont. Born at Montreal, Oct. 27th, 1913. Educ.: B.Eng., McGill Univ., 1939; 1939-40, Jenkins Bros. Ltd.; 1940-42, Engrg. Officer, R.C.A.F.; 1942 to date, Chief Engr. Officer, No. 1 S.F.T.S., R.C.A.F., Camp Borden, Ont. (Jr. 1941).

References: R. DeL. French, C. M. McKergow, E. Brown, D. B. Barry, A. R. Roberts, E. T. Buchanan.

CAPE—JOHN MEREDITH, M.B.E., Lt.-Col., of Montreal Que. Born at Montreal, April 29th, 1910. Educ.: R. M. C., Kingston, 1932; 1932-33, engr. Entreprises Centrales Francaise, Paris, France; 1934-39, estimating & job engr., E. G. M. Cape & Co., Montreal (since 1938, engr. & director); 1939-Mar. 1945, Can. Active Army, Overseas; at present, Director, E. G. M. Cape Co. Ltd (Jr. 1934.)

References: E. G. M. Cape, J. B. Stirling, W. H. Noonan, J. P. Leclaire, LeR. Grant.

LOVE—HERBERT WAINWRIGHT O.B.E., Lt. Col., R.C.E., of Toronto. Born at Toronto, Nov. 7th, 1913. Educ: R.M.C., 1935 & B.Sc. (Civil) Queen's Univ., 1936; With R.C.E. as follows: 1936-38, engr. i/c Valcartier Camp, Que., on constrn. of camp; 1938-40, Works Officer, M.D. 5, Que.; 6 mos. 1940, D.E.O., M.D. 3, Kingston; Proceeded overseas 1940 & since Aug. 1943 on engrg. aspects of planning & conduct of all 1st Can. Army operations in U.K. & European Theatre. (Jr. 1937.)

References: D. S. Ellis, G. Walsh, J. P. Carriere, J. C. Oliver, W. A. Capelle, R. A. Low, L. F. Grant, L. T. Rutledge, A. Jackson.

MILES—CHARLES WILLIAM EDMUND, of Montreal, Que. Born at Calgary, Alta., Feb. 10th, 1911. Educ.: R.M.C., Kingston, 1933; 1933-34, Jr. engr., Imperial Oil Ltd., Dartmouth, N. S.; 1937-39, jr. engr. & mtce. engr., Halifax Refinery, Imperial Oil Ltd.; With R.C.A.F. as follows: 1940-42, Asst. Chief Works Officer, Eastern Air Command, Halifax; 1943-44, Chief Works Officer, Newfoundland; bal. 1944, contrn. engrg. representative, Can. Air Liaison Mission to India; At present, mtce. engr., Imperial Oil Ltd., Montreal East. (Jr. 1942.)

References: R. L. Dunsmore, R. R. Collard, H. R. Montgomery, C. S. Scrymgeour, C. L. Ingles, J. A. Jones.

PETERSON—ROBERT, of Saskatoon, Sask. Born at Eston, Sask., April 12th, 1918; Educ.: B.Sc. (Civil), Univ. of Sask., 1939 & S.M., Harvard Univ., 1941; With P.F.R.A. as follows: 1939-40, instrumn. on surveys, design & constrn. water development; 1941-44, asst. engr.; 1944 to date, soil mechanics engr., located at Univ. of Sask. (Jr. 1942.)

References: G. L. Mackenzie, W. L. Foss, C. J. Mackenzie, R. A. Spencer, E. K. Phillips, N. B. Hutcheon.

WALKEM—RICHARD, of Vancouver, B. C. Born at Vancouver, Feb. 23rd. 1910. Educ.: R.M.C., Kingston, 1932; 1933-37, apptce., Vancouver Iron Works Ltd., 1937-38, office mgr. & cost acct., West Coast Salvage & Contr. Co., 1938-39, sales dept., Vancouver Machinery Depot, 1939-45, artillery officer, Canadian Army Overseas, at present second-in-command field artlry. regt., returning to civilian life, Vancouver Machinery Depot. (Jr. 1937.)

References: Geo. A. Walkem, L. A. Wright, E. A. Cleveland, J. Robertson, T. V. Berry, W. T. Fraser.

FOR TRANSFER FROM STUDENT

ANDERSON—CLARENCE ARTHUR, Capt., of Kingston, Ont. Born at Winnipeg, Man., March 4th, 1918. Educ.: B.Sc. (Elec.) Univ. of Man., 1942; summer 1940, asst. electrician, Banff Springs Hotel; summer 1941 lab. technician, R.C.A.F. Radio Tech. School, Univ. of Man.; 1942 to date, O/C Electronics Wing, Can. Radar Trng. Centre, Barriefield, Ont. (St.1942.)

References: E. P. Fetherstonhaugh, N. M. Hall, E. R. Love, A. E. Macdonald, G. H. Herriot.

CHARTERS—STEWART ANDERSON, Capt., R.C.A., of Montreal. Born at Montreal, Que., Oct. 17th, 1913. Educ.: B. Eng., McGill Univ., 1936; 1936-42, sales engineer then asst. sales mgr., Watson Jack & Co. Ltd., Montreal; 1942 to date, Captain, R.C.A., Petawawa Mil. Camp. (St. 1936.)

References: M. F. Macnaughton, H. M. Esdaile, R. E. Jamieson, R. F. Legget.

HALL—GORDON HUDSON, Capt., R.C.C.S., of 177 Balmoral Ave., Toronto. Born at Peterborough, Ont., Feb. 10th, 1915. Educ.: R.M.C., 1938 and B.Sc. (Elec.) Queen's Univ., 1940; 1938 to date, Officer in Royal Canadian Corps of Signals, at present student, Radio College of Canada. (St. 1937.)

References: D. S. Ellis, D. M. Jemmett, C. E. Sisson.

HUDSON—GEORGE WAUGH, of 149 Fontaine St., Hull, Que. Born at Winnipeg, Man., Mar. 6th, 1917. Educ.: B. Eng. (Elec.) McGill Univ., 1942; With Radio Br. National Research Council as follows: -1942-43, senior research asst., (Air Force Section); 1943-45, asst. engr. on radio equipt. projects for Army; Mar. 1945 to date, asst. engr. i/c mtce. & constrn. of test equipt. (St. 1942.)

References: R. E. Jamieson, C. Craig, F. A. Sweet, H. W. Lea, I. S. Patterson, A. M. Hudson.

LAUCHLAND—LYMAN STUART, A/Lt. Col., of 135 Yorkville Ave., Toronto. Born at Dundas, Ont., Sept. 14th, 1909. Educ.: B.A.Sc., 1934 & M.A.Sc., 1938 (Elec.) Univ. of Toronto; 1937-40, instructor & lecturer, elec. engrg., Univ. of Toronto, on leave of absence since 1940; 1940-42, Capt. R.C.A.; 1942-44, O.M.E. in R.C.O.C.; 1944-45, Major E.M.E., tech. liaison officer at research & devlpt. estab., and at present, Technical Staff Officer. (St. 1929.)

References: C. R. Young, W. S. Wilson, F. F. Fulton, G. M. Carrie, E. P. Innes, C. F. Morrison.

MacVANNEL—DUNCAN PINE, Lieut. (E), R.C.N.V.R., of 169 Fifth Ave., Ottawa, Ont. Born at Picton, Ont., Nov. 20th, 1919. Educ.: B.A.Sc., Univ. of Toronto 1943; 1938-39, lab. asst. Nat. Research Cl., Ottawa; May-Sept. 1940 and May-Sept. 1941 millwright, Steel Co. of Can.; May-Sept. 1942, Nat. Res. Cl., i/c testing ships' hulls and seaplane floats; since 1943 Lieut. (E) in R.C.N.V.R., at present responsible for mtce. of guns, mountings, etc., in Sydney, N.S., area. (St. 1939.)

References: J. H. Parkin, E. A. Allcut, G. R. Lord, C. R. Young.

McMULLEN—WILLIAM FRANCIS, Lt. Col., R.C.A., of 45a Claxton Blvd., Toronto, Ont. Born at Havelock, Ont., Feb. 18th, 1914. Educ.: B.A.Sc. (Elec.), Univ. of Toronto, 1935; 1935-36, Demonstrator, elec. engrg., Univ. of Toronto; with Can. Gen. Elec. Co., as follows: 1936-37, Test Course; 1937-39, Engrg. Dept.; 1939-40, Supply Dept., head office. Since 1940 officer in Royal Can. Artillery, at present Lt. Col., 3rd Anti-Tank Regt., Overseas. (St. 1933.)

References: C. E. Sisson, G. R. Langley, J. S. Keenan, A. L. Dickinson, R. L. Dobbin.

MORISON—GEORGE ALFRED, of Crandall, Man. Born at Crandall, Mar. 1st, 1918. Educ.: B.Sc., (Civil), Univ. of Man., 1943; 1940-42, rodman, instrmn., bldg. insptr., and finally asst. engr. i/c constrn., W&B section, R.C.A.F., Rivers, Man.; 1943-Dec. 44, engr. officer, R.C.E., Petawawa, Ont.; Dec. '44 to date, Infantry officer, transit camp, Debert, N.S. (St. 1942.)

References: N. M. Hall, A. E. Macdonald, E. P. Fetherstonhaugh, A. J. Taunton, D. W. Laird.

VAIL—GILBERT FRANK, Elect. Lieut., R.C.N.V.R., of 138 Dunington Drive, Toronto, Ont. Born at Sydney, N.S., Apr. 27th, 1918. Educ.: B. Eng. (Elec.), N.S. Tech. Col., 1943; with Eastern Light & Power Co. Ltd., as follows: 1938 (5 mos.) on town utility survey & serviceman; 1939 (3 mos.) serviceman, meter repairs, surveying & drafting; 1940 (4 mos.) structl. drafting, constrn.; 1942-43, college electrn., N.S. Tech. Col.; at present, Elect. Equipt. & Trials Officer, Great Lakes Area, R.C.N.V.R. (St. 1942.)

References: E. M. Smythe, C. V. Dunne, W. P. Copp, C. H. Burchill, H. R. Theakston, D. S. Nicol, F. H. Sexton.

AN URGENT REQUEST

Would members who do not file the *Journal* kindly return their June 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 four articles on Air Transportation appearing in that number are being reprinted as Aeronautical Reprint No. 12 of the *Journal*, so that members who wish to keep these papers will be supplied with copy of the reprint in return for their June copy of the *Journal* if they so desire.

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

CHEMICAL ENGINEER (or experienced mechanical) is required to act as superintendent of a sulphite mill operated by a pulp and paper company in the St. Maurice Valley. Some experience in sulphite department of a paper mill is essential. Preference will be given to a veteran. Salary would be between $300 and $375 a month, depending on experience. Apply to Box No. 2985-V.

CHEMICAL ENGINEER with training that would enable him to join the technical section and ability to write good English, is required to act as assistant editor of an engineering publication published in the Montreal area. Some experience in the pulp and paper industry is required and a good personality is important. This position is being held open for a veteran of this war. Apply to Box No. 2999-V.

PAPER MILL FOREMAN is required by a paper company in the St. Maurice Valley to learn paper-making. Preference will be given to an ex-service man and salary will be from $225 to $300 a month. Apply to Box No. 3022-V.

CHEMICAL ENGINEER is required by a paper company in the St. Maurice Valley for work involving wood preparing, ground wood and sulphite. Previous experience is essential. Preference will be given to ex-service man under 30 years of age and salary will be between $225 and $275 a month. Apply to Box No. 3021-V.

CIVIL

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, young graduate, is required for permanent position in Montreal by a firm of contractors and builders, to do estimating, design and draughting work,. Overseas service with Royal Canadian Engineers will be most favourably considered. Salary will be about $200.00 a month depending on experience, Apply to Box No. 2959.

CIVIL ENGINEER, recent graduate is required by a railway company in Montreal for general draughting work in their track department. Apply to Box No. 2973-V.

CIVIL ENGINEER graduate, about 30 years old, with some experience in structural steel, is required by a bridge company in Ontario as sales engineer and to represent the company to senior officials of other companies. Salary would be approximately $300 a month. Apply to Box No. 2981-V.

CIVIL ENGINEER is required to act as assistant to building commissioner of a city in Ontario to examine buildings and plans for conformity with building codes. Preference will be given to veterans of this or the last war. Salary will be between $2000 and $2500 a year. Apply to Box No. 2982-V.

CIVIL ENGINEER with some experience is required to act as resident engineer for road construction work for a paper company with headquarters in Montreal. Apply to Box No. 3002-V.

CIVIL ENGINEER with fair knowledge of field engineering and surveying is required for general engineering work in connection with the Veterans Land Act. Preference will be given to an ex-service man and salary would be approximately $200 a month. Apply to Box No. 3007-V.

CIVIL ENGINEER is required to act as draughtsman on an immediate project involving work on a transmission line, railway spur, steam power station, etc. This position is with an engineering company in Montreal at a salary to be discussed with the candidate. Apply to Box No. 3009-V.

CIVIL ENGINEER with a couple of years' experience on road and bridge work is required to act as assistant county engineer of a county in southern Ontario. Preference will be given to a returned service man and starting salary will be $2500 a year. Apply to Box No. 3015-V.

CIVIL ENGINEER, experienced field engineer under 50 years of age is required for active construction work with a firm in Montreal. Apply to Box No. 3017-V.

ENGINEER-SECRETARY—a young graduate engineer with some experience is required to act as secretary-treasurer of a board of trustees formed for the purpose of the improvement of a district in eastern Ontario, and to supervise the anticipated development of a townsite in the neighbourhood of a recently established mine. Salary will be between $200 and $250 a month. Apply to Box No. 3029-V.

ELECTRICAL

ELECTRICAL SALES ENGINEER for western firm specializing in engineering sales and service of all types of electrical machinery and similar equipment. The position would be permanent and on a salary basis. Applicants should state training, experience, age, nationality and availability. Apply to Box No. 2911-V.

ELECTRICAL ENGINEER, graduate, with several years' experience on communication work is required to act as electronics engineer by a large company in Montreal for work involving engineering new installations utilizing electronics equipment. Apply to Box No. 2957-V.

ELECTRICAL ENGINEER between 25 and 35 years old is required by a company in Montreal engaged in the installation of low tension signalling devices, to act as a sales engineer. Personality and appearance are important and some experience is necessary. Preference will be given to a returned service man and salary would be $4000 a year to the right man. Apply to Box No. 3012-V.

ELECTRICAL ENGINEER with some experience between 30 and 40 years of age is required for interesting work on the installation of equipment in a new mill being built by a company engaged in the production of steel. This position will be in southern Ontario and while temporary, might lead to permanent work. Salary would be between $300 and $400 a month depending on experience. Apply to Box No. 3013-V.

ELECTRICAL ENGINEER with some pulp and paper experience is required to act as assistant electrical superintendent for a paper company in the St. Maurice Valley. Preference will be given to ex-service man about 30 years old and salary will be $275 to $300 a month. Apply to Box No. 3026-V.

MECHANICAL

MECHANICAL ENGINEER, graduate, about 30 for well-established concern engineering and manufacturing conveying equipment in their own plant. A working knowledge of mechanics and light structural steel, along with the aptitude for applying same, also the desire to learn the conveying business from the ground up is essential. This is a permanent position for the right man. Apply to Box 2942-V.

SEVERAL PROJECT ENGINEERS are required by a company engaged in the manufacture of mechanical and electrical equipment in Montreal. Candidates should be graduates in mechanical engineering with some electrical background, with five years experience in product design and under thirty-five years of age. The salary would be in the neighbourhood of $400 a month, with good prospects for advancement to positions such as that of assistant chief engineer and chief draughtsman. Apply to Box No. 2990-V.

MECHANICAL ENGINEER, not necessarily a graduate, is required by a firm of boilermakers and iron founders in southern Ontario, to learn the business with the object of becoming purchasing agent. Apply to Box No. 3003-V.

MECHANICAL ENGINEERS, over 35 years old, with good plant experience in production or design are required by a firm of industrial consultants in Montreal. Salary would be between $400 and $500 a month. Apply to Box No. 3005-V.

MECHANICAL ENGINEER between 35 and 40 years of age with some paper mill experience is required to act as efficiency engineer in the wood room and wood operations of a paper company in eastern Ontario. Salary is open according to experience. Apply to Box No. 3008-V.

MECHANICAL ENGINEER, graduate, with about three years' experience between 25 and 30 years old, is required for general design work, etc., by a company engaged in the production of structural steel in Montreal at a salary between $225 and $250 a month. Apply to Box No. 3010-V.

MECHANICAL ENGINEER with a minimum of five years' experience and between 30 and 40 years of age, is required to act as assistant chief engineer for a firm of boilermakers and iron founders in southern Ontario. Salary would be between $300 and $350 a month. Ap.ply to Box No. 3014-V.

MECHANICAL ENGINEER for work in connection with logging engineering is required by a paper company with headquarters in Montreal. Apply to Box No 3019-V.

CHIEF DRAUGHTSMAN with engineering and draughting experience in the pulp and paper industry is required for a senior position with a paper company in the St. Maurice Valley. Preference will be given to an ex-service man and the salary would be between $300 and $400 a month. Apply to Box No. 3020-V.

MECHANICAL ENGINEER with good academic record, some shop experience, some experience in mechanical draughting and design, and in maintenance and repair of mechanical equipment is required to act as assistant chief engineer for a paper company in the St. Maurice Valley. Preference will be given to returned service men, especially with R.C.E.M.E. experience. Salary would be from $275 to $400 a month, depending on qualifications Apply to Box No. 3024-V.

MISCELLANEOUS

ASSISTANT SUPERINTENDENT is required by the street railway department of a city in western Canada. This is a position with excellent post-war prospects for a young transportation engineer between 35 and 40 years of age, with at least five years' experience. Apply to Box No. 2956-V.

BUSINESS MANAGER, not necessarily a graduate, with some experience in handling people, a fair knowledge of construction and some business background, is required by an institution in southern Ontario. Candidates should be over forty years of age and preference will be given to a dischaged service man, especially if disabled. Apply to Box No. 2979-V.

SALES AND SERVICE ENGINEER is required by a firm engaged in the manufacture of ball and roller bearings, should be an extrovert with engineering background, interested in sales work. Preliminary training will be given in engineering office in Toronto and position will involve considerable travelling. Salary beteen $175 and $200 a month. Apply to Box No. 2983-V.

STEAM PLANT ENGINEER or stationery engineer is required by a pulp and paper company in the St. Maurice Valley, to learn the pulp and paper business. Apply to Box No. 2986-V.

DRAUGHTSMAN is required by a corporation engaged in the production of synthetic rubber. Candidates must have experience in piping work. This position is in southern Ontario and would be worth between $275 and $300 a month. Apply to Box No. 2987-V.

DIRECTOR OF RESEARCH is required by a power and paper company in Ontario. Candidate must have considerable administrative experience and should have the degree of ph.d. The work would involve not only general pulp and paper research but the organization and operation of the research department which this company is planning to establish. Salary would be $7500 a year or more. Apply to Box No. 2992-V.

SALES ENGINEERS are required by a company in Montreal engaged in the manufacture of insulating materials. Candidates must have technical education and preferably some plant operating and sales experience. Conversational knowledge of French desirable. Salary would be $200-$225 a month plus commissions. Apply to Box No. 2993-V.

MINING ENGINEER to give lectures to first two years of geology in a university in New Brunswick. Candidates must be available by September 15, 1945. Apply to Box No. 2996-V.

TWO SALES ENGINEERS between 25-35 years of age, with energy, common sense and a general engineering backgroung are required to work in a small company in Ontario engaged in the manufacture of miscellaneous mechanical equipment. These positions are worth between $200 and $250 a month and have a very good future for the right men. Apply to Box No. 3001-V.

SEVERAL SALES ENGINEERS are required by a manufacturing company in southern Ontario. Candidates may be graduates or non-graduates in any kind of engineering and would attend a sales engineering school operated by this company for a year. Salary would be $100 a month while learning in addition to any rehabilitation monies coming to them from the Government. Apply to Box No. 3004-V.

SEVERAL RECENT GRADUATES with good character and personality and general engineering background are required by an engineering company in Montreal to start on draughting or field work. Apply to Box No. 3009-V.

GRADUATE ENGINEER about 30, with two or three years general engineering experience is required for statistical work in connection with collective bargaining, job evaluation, etc., for a company in Montreal. Salary would be $250 a month. Apply to Box No. 3011-V.

GENERAL SUPERINTENDENT, between 30 and 45 years of age with at least five years' experience in contracting and building is required by a firm of contractors and builders in the Montreal area. Salary would be from $300 a month depending on experience. Apply to Box No. 3018-V.

SEVERAL ENGINEERING DRAUGHTSMEN, preferably ex-service men, 30 years or younger, are required by a paper company in the St.Maurice Valley. Salary would be between $160 and $250 a month depending on experience. Apply to Box No. 3023-V.

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

CHEMICAL ENGINEER. Young man about 25 years of age, preferably single because of travelling involved, and with experience of a year or more is required to become a sales engineer for an engineering firm in Montreal engaged in installation of acid resistant linings for pulp and paper machinery. The starting salary would be in the neighbourhood of $200. a month. Apply to Box No. 2970-V.

CIVIL

CIVIL ENGINEER, recent graduate, is required by a construction company to start in their filing department and draughting room with the object of becoming thoroughly qualified for work in the field. Headquarters of this firm is in Montreal and the starting salary would be $175. a month. Apply to Box No. 2916-V.

CIVIL ENGINEER to be trained from scratch, if necessary, as assistant to municipal engineer of township in southern Ontario. Starting salary $165. a month. Apply to Box No. 2978-V.

CIVIL ENGINEER. A young graduate with some experience in construction work is required to assist in extension of airport facilities near Montreal. Salary open according to experience. Apply to Box No. 2991-V.

CIVIL ENGINEER, graduate, with land surveyor's certificate between the ages of 25 and 30 is required to work with a firm of consulting engineers and land surveyors in south-eastern Ontario with eventual prospect of partnership. Starting salary would be $200 a month. Apply to Box No. 2980-V.

GRADUATE ENGINEER is required to take over management of a plant engaged in the production of lime in south-eastern Ontario. Candidates should be young men with some experience in construction and in organizing men and handling equipment. Good prospects for man with ideas and initiative to make this a really worthwhile project. This position is worth approximately $300 a month Apply to Box No. 2922-V.

CIVIL ENGINEER is required by a railway company in Montreal to act as an expert on structural steel and concrete as applied to buildings. This position is worth $3000. a year. Apply to Box No. 2951-V.

CIVIL ENGINEERS. Several graduate engineers, either civil or mechanical between the ages of 22 and 30 are required to start as structural steel draughtsmen with the opportunity of becoming structural steel designers and sales engineers. The starting salary varies with experience between $185. and $250. a month. Apply to Box No. 2961-V.

GRADUATE ENGINEER between 30-40 years of age is required to act as assistant professor in a university in central Canada, to supervise draughting in junior years and to do some lecturing on varied subjects with the department of civil engineering. This position would be worth approximately $3000. a year. Apply to Box No. 2976-V.

ELECTRICAL

GRADUATE ENGINEER, electrical, mechanical or civil with two to three years' experience is required by a firm of specialists in scientific illumination to be trained to act as sales engineer for this firm. The training period will be spent in Toronto at $180. a month. Apply to Box No. 2905-V.

ELECTRICAL ENGINEER, university graduate with general maintenance experience of not less than three years in any branch of sound engineering is required for the post of electrical maintenance supervisor. Salary for this position will be in the neighbourhood of $2400. a year and the location will be in Ottawa. Apply to Box No. 2949-V.

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.

MECHANICAL

MECHANICAL ENGINEER, preferably with some experience in the pulp and paper industry is required for draughting and design work with a pulp and paper company in the Lake St. John district at a salary of approximately $300. a month. Apply to Box No. 2941-V.

TWO SENIOR DRAUGHTSMEN with some knowledge of aircraft to work on modifications and repairs of aircraft. This company is situated in the Montreal area. Salary would be in accordance with the qualifications of the applicant. Apply to Box No. 2948-V.

MECHANICAL ENGINEER with tool and die experience and extensive background in intricate work such as small dies, instrument fitting, gauges, etc., and some experience in installation work covering motors, pumps, tanks, etc., is required to act as mechanical design and maintenance supervisor of a motion picture laboratory. This position will be in Ottawa at a salary of approximately $3000. a year. Apply to Box No. 2950-V.

MECHANICAL ENGINEER, graduate, preferably with at least 3 years experience as junior mechanical engineer is required to work in the Drummondville plant of a large manufacturing company. Must be bilingual and will be responsible for executing production schedules, maintaining quality standards and maintenance of equipment. Age preferably between 23-27 years. Salary to be discussed with applicant. Apply to Box No. 2756-V.

MECHANICAL ENGINEER, young man, bilingual, is required to act as assistant to the chief engineer of a firm engaged in the manufacture of soft drinks. He will be required to do most of the active mechanical engineering of the plant and must be willing to work at times in overalls but be able to represent the company in New York and Ontario, etc. This position is in Montreal at a salary in the neighbourhood of $75. a week. Apply to Box No. 2960-V.

MECHANICAL ENGINEER with some experience in factory operation and routine, including machine shop and bench assembly operations, and if possible, some experience in the manufacture of wire and cable, telephone and switchboard assembly work is required by a firm engaged in this line in south-eastern Ontario. This position would entail establishing production standards through time and motion study, analysis of shop operations, etc. Candidates should be under 35 years of age and can expect a salary of between $175. and $250. a month depending on their experience. Apply to Box No. 2967-V.

MECHANICAL ENGINEERS. Several young graduates are required for work involving sales, service and design of mining machinery and pulp and paper equipment. Headquarters of this firm is in Montreal and these positions might be there or in one of their branches scattered across Canada. Salary would be open according to experience. Apply to Box No. 2975-V.

MISCELLANEOUS

SALES ENGINEER with some technical training, not necessarily a graduate, preferably bilingual, is required by a company engaged in sheet metal work. This position is in Montreal and the starting salary would be about $175. a month. Apply to Box No. 2930-V .

DESIGNING ENGINEER with pulp and paper mill experience is required for a mill in Newfoundland. This position is worth between $250. and $350. a month depending on qualifications. Apply to Box No. 2937-V

TWO WELDING APPRENTICES, young graduates, are required to work for a firm engaged in specialized welding jobs in the Montreal area. These men will start in the shop for a period of about six months and then proceed through a period in the draughting room into the field as sales engineers with good prospects for promotion for the right men. The salary during the training period will be the equivalent of the current shop rates. Apply to Box No. 2946-V.

SEVERAL ENGINEERS are required by a firm engaged in the manufacture of pressure vessels, storage tanks, steel plate work of all kinds. Candidates should be between 25 and 35 years old with general engineering background and ability to handle people. These positions will be in Toronto or Montreal at a salary of between $150 and $300 a month depending on experience. Apply to Box No. 3000-V.

GRADUATE ENGINEERS either civil or mechanical are required by a bridge company in the Montreal area for draughting and design work in connection with structural steel and mechanical equipment. An electrical engineer is also required for work in connection with wiring diagrams. These positions would be worth approximately $225. a month. Apply to Box No. 2971-V.

CIVIL ENGINEER, recent graduate with emphasis on candidate's attitude and character rather than experience is required by a consulting engineer in Montreal at a salary varying between $175. and $225. a month depending on qualifications. Apply to Box No. 2977-V.

THE CIVIL SERVICE COMMISSION is on the lookout for engineers for four grades, 1, 2, 3 and 4 at salaries ranging from $1800. to $4200. a year; Further details and application forms will be sent on request.

THE DEPARTMENT OF PUBLIC WORKS in Ottawa is looking for two engineers, Grade 1, for public works reconstruction at a salary range of $1800. to $2400. a year.

THE DEPARTMENT OF MINES AND RESOURCES is contemplating the establishment of a number of positions, including surveys engineers, Grade 1, 2 and 3 at salaries ranging from $1800. to $3200. a year; associate geologists and geologists at salaries ranging from $2200. to $4600. a year. There are also vacancies for senior Map draughtsmen and Mines engineers, Grade 1, at salaries between $1800. and $2160. a year. Forestry engineers, Grade 1, Hydrographers, Grade 1 and a Water and Power engineer are also required in this same salary range. A Forest Products engineer, Grade 3 is required in Vancouver at a salary of between $2820. and $3240. a year.

PROSPECTS OF BUSINESS WITH INDIA

A member of the Institute, located in the United States, has offered to establish contacts with the India Industrial Mission which is about to visit the United States, for any of the younger members of the Institute interested in possible positions in India, or for members who are in such positions where they may wish to establish business relations with India. Write Headquarters.

Situations Wanted

SALES ENGINEER, Mechanical engineer, M.E.I.C., P.E.Q., age 39, experienced in general machinery, boilers, pumps, mechanical equipment of buildings, etc., some sales experience, desires position as sales engineer with headquarters in Montreal, with progressive firm manufacturing or handling varied range of equipment. Apply to Box No. 270-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., R.P.E., in B.C., 40 years of age, married, 8 years' experience as superintendent and field engineer on construction including skeleton steel, reinforced concrete and timber structures. Some experience in taking off quantities and in design of water distribution systems. Eleven years' experience in supervisory and managerial positions in manufacturing. At present engaged as factory manager in the manufacture of a line of engineering products. Seeking a permanent position in a well-established organization where there will be greater scope for my abilities. Will be available on reasonable notice, under W.B.T.P. regulations. Applyto Box No. 880-W.

CIVIL ENGINEER desires part-time employment. Experience in design, estimating,, draughting, supervising work, field engineer in municipal and highway works, also in heating, air conditioning and mining. Owns a dca. Apply to Box No. 1859-W.

GRADUATE PROFESSIONAL ENGINEER proposing to establish consulting engineering practice would like to confer with engineer interested in similar proposition. Must have experience in the various mechanical trades of the building industry. Apply to Box No. 2099-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., with 16 years experience in Canada and abroad in tool machines, tool design, general machine design, shop and industrial engineering, and as chief industrial engineer in plant employing 6000 men. At present chief engineer with large aircraft manufacturing company in Montreal. Successful organizer, age 40, available shortly. Apply to Box No. 2502-W.

CIVIL AND MECHANICAL ENGINEER, M.E.I.C., R.P.E. (Que.), B. A. Sc. (honours) Toronto, desires administrative position with responsibility in an expanding and progressive industry. Applicant has ten years engineering and supervisory experience, four years in design, estimating, fabricating and erection of steel plate work, and six years in plant layout and design, mechanical equipment design and installation, and administration of engineering, maintenance and construction departments of a large plant. Excellent references. Available under W.B.T.P. regulations PC 2496. Apply to Box No. 2503-W.

CIVIL ENGINEER, Jr.E.I.C., age 31, married, temporarily employed by Naval Service; four years general experience including road construction, draughting and design, purchasing, six years in government service, past four as resident engineer on Naval Base construction; desires position leading to purchasing work with large industrial or contracting company; location immaterial. Available on one month's notice. Apply to Box No. 2504-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., with experience in design and manufacturing of pulp and paper machinery, for the past thirteen years superintendent in charge of maintenance and construction with large newsprint mills, is open for new engagement in position of responsibility. Immediately available under the regulations of the W.B.T.P. Apply to Box No. 2505-W.

GRADUATE CIVIL ENGINEER with 10 years experience in surveying estimating, heavy construction, municipal work, water supply systems, etc., would prefer position with small contracting concern. Apply to Box No. 2506-W.

Registered professional engineer with considerable sales, administrative and technical experience, desires to open office representing electrical manufacturer. Apply to Box No. 2099-W.

TEACHER WANTED

The Winnipeg Public School Board wishes to secure a teacher for the Electrical Department of the Kelvin Technical High School, duties to commence September 1st, 1945. A graduate in electrical engineering having experience with electric motors and dynamos is preferred. Salary schedule: without university degrees — $2,100, minimum, $2,800, maximum; with university degrees—$2,400, minimum, $3,400 maximum.

Further information regarding duties and salary may be obtained from the Secretary-Treasurer, School District of Winnipeg, No. One, Winnipeg, Manitoba.

Professor of Electrical Engineering

University of London—The Senate invite applications for the Chair of Electrical Engineering tenable at King's College (salary £1,150). Applications must be received, not later than first post on 17th September, 1945, by the Academic Registrar, University of London, Richmond College, Richmond, Surrey, England, from whom further particulars should be obtained.

WANTED

Two Mechanical Design Engineers

Experience in design, planning and estimating along some of the following lines is required: machinery layout, installation of mechanical power transmission equipment, pumps and piping, general machine design, steam piping and boiler house installations, conveying equipment and sawmill machinery.

Previous paper mill experience is very desirable but not essential.

APPLY TO:

PACIFIC MILLS LIMITED - Ocean Falls, B.C.

UNIVERSITY OF TORONTO REQUIRES ENGINEERING INSTRUCTORS

The Faculty of Applied Science and Engineering of the University of Toronto will require a considerable number of demonstrators, instructors, and lecturers to undertake teaching duty for classes of ex-service men in the Session 1945-46 and later. Applicants should be engineering or science graduates. They may in approved cases be permitted to do graduate study for an advanced degree. Salary will depend on experience and general qualifications.

Apply to the Secretary of the Faculty of Applies Science and Engineering, Mining Building, University of Toronto.

WANTED

One second-hand Transit (light). Apply giving description and price to Box No. 59-S.

Industrial News

Industrial development—new products—changes in personnel—special events—trade literature

HEAVY ENGINEERING PRODUCTS

Dominion Bridge Co. Ltd., Lachine, Que., have issued a 48-page book entitled "Builders in Steel". It traces the development of the company since its foundation in 1880 and shows examples of its main activities in the field of heavy engineering products. There are numerous illustrations of bridges, steel building structures, heavy handling equipment, steel platework, boilers and many other items erected and fabricated by this company or its subsidiary and associated companies in all parts of the Dominion. An item which appeared in the May issue of the Journal, wrongly captioned "Heavy Steel Forms", referred to an earlier, condensed coverage of the same subject.

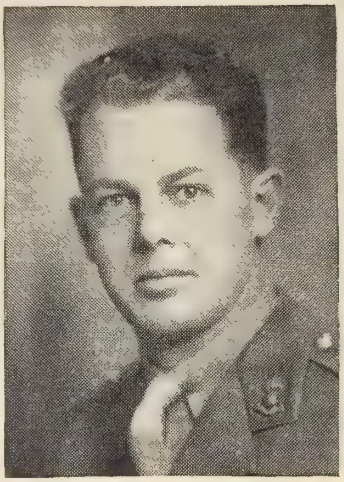
VISUAL EQUIPMENT HANDBOOK

Associated Screen News Ltd., Montreal, Que., Canadian representatives of Bell & Howell of Chicago, Ill., have for distribution a 20-page booklet, designed to aid the architect in planning for the installation of the equipment and wiring necessary to make possible the effective and convenient use of motion pictures in classrooms, conference rooms and auditoriums. The contents are divided into two parts, the first dealing with classrooms and conference rooms in terms of seating arrangement, location of equipment, electrical specifications, illumination and acoustics and related topics. Part II covers auditorium specifications, with particular reference to acoustics, positioning of the projector and loud speaker, size and location of screen, provision of service rooms, etc. Charts and diagrams, including projection layouts for square and rectangular school rooms, a projector arrangement for a school auditorium, wiring diagrams, diagrams of projection mounting, loud speaker mounting, etc., are included.

NEW DIRECTOR

The Waterloo Manufacturing Co. Ltd., Waterloo, Ont., has announced the election to its board of directors of J. G. Lorriman. Mr. Lorriman is manager of the Ontario division, Eastern Steel Products Limited, Preston, and a director of that company.

J. G. Lorriman



W. J. Waddell

JOINS NEPTUNE METERS

W. J. Waddell, who was recently released from the army after serving overseas as a captain in the Royal Canadian Artillery, being awarded the Military Cross, has joined the sales staff of Neptune Meters Limited, Long Branch, Ont.

Capt. Waddell, a son of W. H. Waddell, City Engineer of Owen Sound, Ont., was educated at Ridley College, St. Catharines Ont., and prior to the war was with the the Surveys Branch of the Ontario Department of Highways.

INSPECTION AND EXPEDITING SERVICE

Chas. Warnock & Co. Ltd., Montreal, Que., have prepared a 20-page booklet, which outlines the services offered by this organization in the inspection and reporting on raw materials, goods in the process of manufacture, and structures under construction and erection. These services involve both shop and field control as well as laboratory testing. Noted in the indexed list of service coverage are such varied items as inspection of primary materials, aggregates, brick, building, stone, castings, fabricated and welded structures and equipment, pipes, soil tests, timber, transportation equipment, and many others. Each of these types is given separate treatment in the booklet, including a description of methods of sampling and control, inspection technique, etc.

LINK-BELT OFFICERS

At a recent directors' meeting of Link-Belt Limited, Fred M. Conant was elected a director and George E. Kaiser was appointed assistant treasurer, in charge of finance and accounting .

Mr. Conant, who is also secretary of the company has been a Link-Belt employee since 1909.

Mr. Kaiser joined the company in 1929 and prior to his appointment as assistant treasurer held the position of manager of the company's northern office and warehouse at Swastika.

ADVERTISING MANAGER

The appointment of H. J. G. Jackson as advertising manager of Chrysler Corporation of Canada Ltd. has been announced by C. W. Churchill, president.

Mr. Jackson is a native of Windsor, Ont., and a graduate of the University of Toronto. After sales experience in Windsor and Toronto, he entered the advertising department of Chrysler in 1934.

HEAT EXCHANGERS

Darling Bros. Ltd., Montreal, have issued a 9-page booklet dealing with problems encountered in the installation, operation and maintenance of Darling-Whitlock exchangers.

DECEASED

Well known internationally in the automotive, hardware, and fire extinguisher supplies trades, Edward G. Weed died suddenly on April 23rd, after suffering a heart seizure following a directors' meeting.

Active in the fire extinguisher manufacturing industry, Mr. Weed was president of Pyrene Manufacturing Co. of Canada Ltd.; executive vice-president of Pyrene Manufacturing Co. at Newark, N.J., and director of both companies. He was also director of C-O-Two Fire Equipment Co., Newark; C-O-Two Fire Equipment Co. of Canada, and the Chemical Concentrates Corporation of New Jersey.

Born at Hickory Grove, Pa., he came to Canada in 1913, at which time he held the position of general manager of Canadian National Carbon Company. In 1917 he went to Chicago, where he became manager of the Chicago branch of that firm. He returned to Canada in 1922 to establish the Pyrene Manufacturing Company in Toronto. Six years later he went to Newark, N.J., where he held the position of vice-president of Pyrene Manufacturing Company, and in 1943 was made executive vice-president.

Edward G. Weed

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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CONTENTS

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COVER PICTURE

The cover picture shows the fractionation section columns of Imperial Oil's gasoline plant at Montreal East. In those columns crude oil at a certain temperature is submitted to a controlled pressure which actually cracks the molecules thus permitting the separation of lubrication and fuel oils and achieving better power value. (*National Film Board Photo.*)

THE CANADIAN UNIVERSAL TRESTLE

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History of Development

Early in 1942, Major-General J. P. Mackenzie, M.E.I.C., who was Quartermaster General of the Canadian Army, conceived the idea of a separate organization to develop new field equipment for the Corps of Royal Canadian Engineers. In July 1942, the Directorate of Engineer Development was formed under the direction of Colonel E. C. Thorne, M.E.I.C., Royal Canadian Engineers, at National Defence Headquarters, as a unit of the branch of the Quartermaster General to undertake this development work.

Previous to this time, little development had been undertaken in Canada on the many requirements of the Royal Canadian Engineers, such as bridging, demolition explosives, tunnelling equipment, anti-tank mines and the co-ordination of civilian methods and equipment with military needs and practices. Any ideas originating in Canada had been dealt wth overseas by development centres in the United Kingdom. In many instances, Canadian ideas were adopted and incorporated into operational equipment without Canada receiving any credit or being asked to assist in the development. Some Canadian ideas failed to bear fruit because their proponents were not given the opportunity to carry such ideas beyond the stumbling blocks of conservatism and accepted routine technique.

With the formation of the Directorate of Engineer Development, it was agreed that Canada should undertake her own development work and, before long, facilities for Canadian development were made available both in the United Kingdom and Canada.

In October 1942, the idea for a Class 40 Adjustable Universal Trestle was conceived in the Directorate of Engineer Development, and work on its development was commenced.

Design Intention

The purpose of the trestle was to provide an intermediate support, or supports, which would carry the Bailey, the Inglis or the Small Box Girder types of bridges, in either wet or dry gap locations.

By use of the trestle, not only was the maximum width of gap which could be crossed by a given type of bridge increased but, in any given gap, the weight of the main carrying members could be materially reduced.

Design Features

The design features of the original Class 40 trestle may be summarized as follows:

1. Class 40 loading to be provided for.
2. Maximum water depth of 15 ft.
3. Ball joint between footings and legs.
4. Lengths of legs to be independent of each other
5. Independent operation of legs.
6. Transom to be raised or lowered to accommodate bank conditions. Each end of transom to be raised or lowered to compensate for leg settlement. The maximum slope of roadway width to be kept to 3 inches. Lifting capacity of mechanism to be 40 short tons at each end of transom.
7. Launching to be accomplished by—
   (a) Independent flotation on pontoons.
   (b) Suspension from the end of rolling or swinging span.
   (c) Flotation in contact with end of rolling span.
8. Salvage of trestle and footings to be provided for except under extreme conditions when footings could be jettisoned.
9. Flotation to be accomplished with two pontoons in 30 inches of water.
10. After laying out on ground at site, all lifting operations such as leg raising, transom raising, etc., to be carried out by trestle mechanism.

It was only after four months of intensive development and design work carried out by R. C. Manning, B.A.Sc., M.E.I.C, Chief Engineer of the Canadian Institute of Steel Construction, who was working with the Directorate of Engineer Development as Technical Adviser on Bridging that the first protoype was fabricated.

As no facilities were available in Canada to test this equipment under operational conditions, arrangements were made with the United States Army Engineers for the use of one of their bridge test sites. In May 1943, the entire trestle, complete with all equipment and pontoons was shipped to the test site. In the six weeks which followed, the trestle was fully tested, including a full scale river crossing using one trestle and 250 feet of Bailey Bridge. Load and traffic tests were also carried out. These trials were under the supervision of Mr. Manning who was accompanied by an officer of the Royal Canadian Engineers, and working party of four sappers.

From these user trials a great deal more was learned than could have been possible with ordinary static tests. Although a number of minor improvements

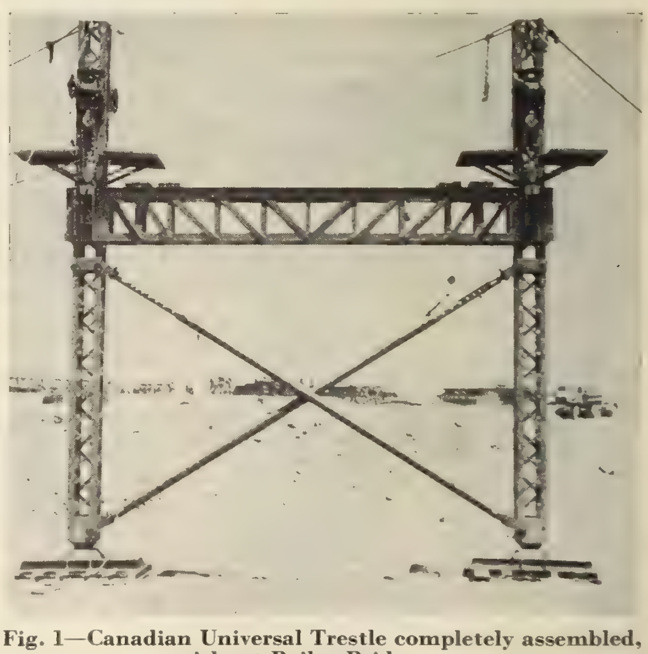

Fig. 1—Canadian Universal Trestle completely assembled, without Bailey Bridge.

Fig. 2—The transom. This figure shows the two half sections spliced together, with transom pins at one end in carrying position and at the other end in pin holes.

were considered essential to improve the operational performance and speed of erection, it was more than gratifying to learn that the basic design and principles of operation were both sound and practical. Moreover, by using Baldwin-Southwark electric strain gauge equipment, it was proved that the stresses in the trestle were well within the allowable limits even with a live load 50 per cent over the design live load.

A full report of the trials, together with motion pictures, was forwarded to the United Kingdom with a request for an opinion on the suitability of the trestle for operational requirements. Although the principles of operation were recognized as satisfactory, there had been an increase to Class 70 in the loading requirements due to the introduction of heavier equipment. Moreover, a survey of potential campaign terrain disclosed that the conditions to be encountered would require the trestle to support the bridge floor at a maximum height of 35 ft. above the river bottom.

Work was started on a Class 70 Canadian Universal Trestle to meet these more rigid requirements. The trestle transom was re-designed and split into two identical sections for ease in handling. The telescopic struts were enlarged and the trestle legs were made up in three sections which locked together.

In order to be able to make a crossing using two trestles and three spans, it was decided to re-condition the original Class 40 trestle using new legs and diagonal struts to meet the new conditions. The original trestle transom was reinforced for the new loading at the test site by the courtesy of the Engineer Board, U.S. Army Engineers.

In January 1944, the new Class 70 trestle, together with new parts required to re-fit the original trestle was shipped and a party of 24 sappers under the command of an officer of the Royal Canadian Engineers, returned to the test site to conduct further trials on the new equipment under the technical guidance of Mr. Manning. After some experimenting, a full scale launching was made using two trestles with 210 ft. of Bailey bridging which resulted in a Class 70 structure consisting of three 70 ft. Bailey spans supported by two trestles. This crossing was made in approximately twelve hours.

There had been considerable controversy about the stresses which would occur should one leg of the trestle sink. In order to settle this question, a complete trestle was set up on shore with the transom raised to 35 ft. above the footings with the diagonal struts fully extended. One footing was placed one foot lower than the other causing a decided lean in the legs of the trestle. Loads were applied by using two 70-ft. Bailey spans just above ground level, one end of which was suspended by cables from the transoms above. Loads were applied by running tanks onto the spans and jacking ends of the span down until the load came on the supporting cables. About 100 strain gauges of the Baldwin-Southwark electric type were used to register stresses at critical points. The trestle carried 150 per cent of the actual reaction which would result when Class 70 loads passed over the bridge in service, without anywhere exceeding the yield point of the steel in its component parts.

During this development period, trestles were also being developed in the United Kingdom of different designs, but for similiar purposes. Keen competition

Fig. 3—The winch frame in place on a stub leg section. Note the unusually large drum diameter.

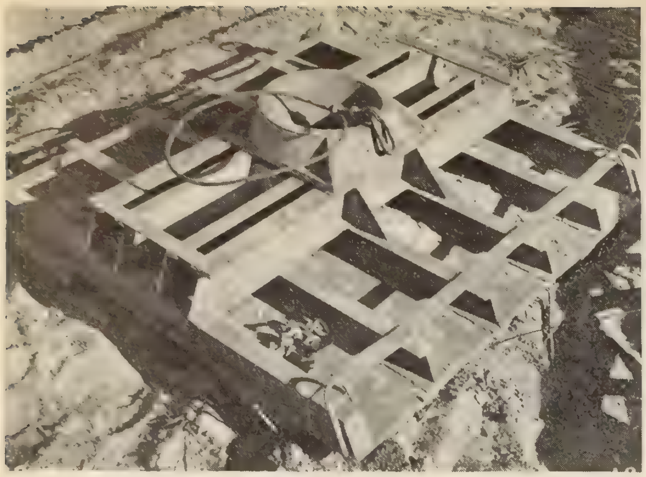

Fig. 4—The trestle footing complete with footing cables.

ensued in order to get prototypes ready for trials as the need was so urgent that the first trestle to pass the tests would probably be accepted although it might not be the best. As it turned out, four specimen trestles, three British and one Canadian were completed almost at the same time. After the trials described above, the Class 70 Canadian Universal Trestle was shipped to the United Kingdom, and demonstrated to the War Office. Shortly afterwards, Canada received an order for Canadian Universal Trestles sufficient to fulfil operational requirements at that date. Recently a second larger order was received for early delivery.

General Description

To appreciate the purpose of the Canadian Universal Trestle, it will be necessary to review the general principles of the Bailey Bridge.

Although the trestle is designed for use with other service bridging, such as Inglis Bridge and Small Box Girder, it must be remembered that Bailey bridging has replaced almost all other types of bridging insofar as operational military equipment is concerned. For this reason, this description will be confined to the use of the trestle with Bailey bridging. The added versatility of the trestle in carrying other types of bridging was not found in the British trestles.

The basic unit of the Bailey Bridge is a standard

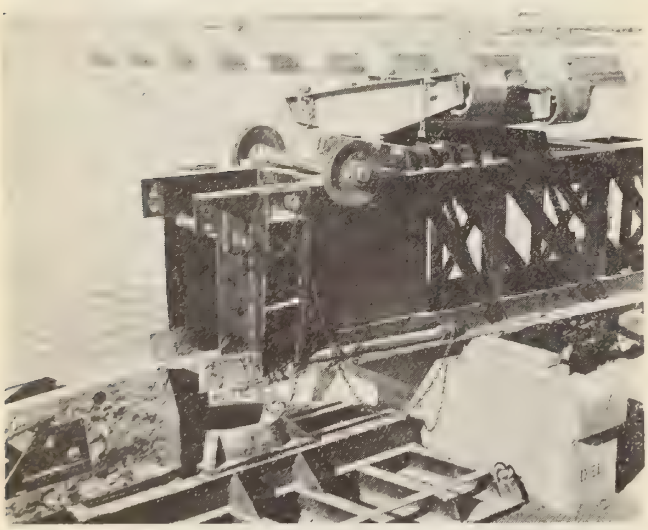

Fig. 5—Showing the transom blocked up, the footing in place under the open leg well, and the bottom leg section ready to lift into place. Note the leg lifting pulley, transom bearings and rocking rollers on the top of the transom.

panel approximately 10 ft. long and 4 ft. 9 in. high, measured centre to centre of pin holes. Except in special cases, which are beyond the scope of this article, the Bailey Bridge is of the "pony" type, transverse floor planks or chesses rest on nests of steel stringers which in turn rest on floor beams or transoms spaced at 5 ft. centres. These transoms are clamped on top of the bottom chord of the panels. The Bailey panels are pinned together to form the bridge trusses. As loads and spans increase, trusses may be added on both sides of the roadway both horizontally and vertically until there are three lines of trusses on each side, each truss line being three panels in depth.

Table I gives the truss arrangement and maximum spans for Class 70 loading.

Table I

Truss lines each side of roadway	*Height*	*Maximum span*
Double	Single	40 ft.
Triple	Single	70 ft.
Double	Double	90 ft.
Triple	Double	110 ft.
Triple	Triple	150 ft.*

* Uneconomical.

For spans in excess of these limits, pontoon bridges or trestles are required.

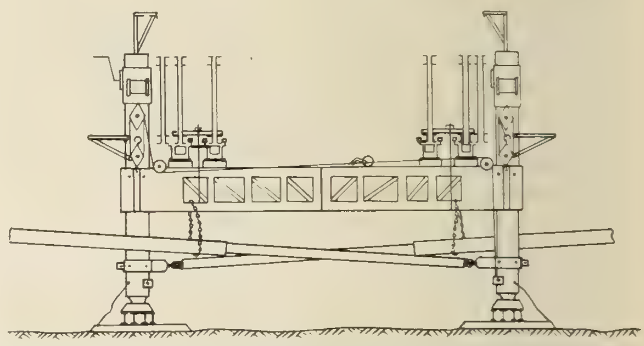

Fig. 6—The trestle is assembled and fastened to the nose of the bridge by trestle suspension slings; the winches are rigged to raise one leg.

It is obvious that some method of saving weight and necessary transport is desirable. Pontoons require considerable transport, especially in such numbers as Class 70 load requires. By using trestles and single storey construction exclusively, overall gaps may be subdivided with intermediate supports and the total weight of bridge material greatly reduced. For example, a gap of 140 ft. crossed by a single span to carry Class 70 load would require a triple-triple Bailey Bridge which contains 252 panels, each panel weighing 570 lb. If a trestle is introduced making two spans of 70 ft., triple single Bailey Bridge will suffice which contains only 84 panels. The saving is 168 panels or about 96,000 lb., while the trestle used weighs only about 20,000 lb.

Design Features of Trestle (class 70)

Referring to Fig. 1 we see that the Canadian Universal Trestle consists primarily of two vertical legs, two footings, one sliding transom, two adjustable tubular braces, and ancillary equipment for raising and lowering the legs and the transom.

The transom consists of two half sections each weighing approximately 1500 lb. These two half sections are pinned together with standard Bailey panel

Fig. 7—Launching has begun with one trestle suspended from the end of the bridge, and rolling forward is under way.

4). On the top is a dish-shaped casting in which the legs rests. The normal bearing area of the footing is 30 sq. ft. This can be augmented if necessary by field expedients.

The diagonal struts are made of steel pipes which telescope to give the desired overall length. A series of holes are drilled in the female pipe to match the various holes in the legs of the trestle. The holes in both the legs and struts are numbered for easy identification. The splice in the strut is completed by the insertion of a pin. The strut gates and collars are shipped loose with pins for attaching to the legs and struts.

Miscellaneous parts, such as bridge bearings, leg lifting brackets, guy connectors and twin pulleys are provided. The complete trestle includes necessary wire rope, clips and thimbles to form guys, ratchet hoists and wire rope grips as well as materials for dead men and bank seats.

The rollers used in launching the trestle are standard Bailey equipment as are the junction end posts and links which are used at the junctions of the spans over the trestle.

pins through a male and female connection at the centre of the transom. The transom is a double-trussed girder of welded construction, with a well at each end which accommodates the trestle leg. There is a gate on the end of transom which can be removed to allow the leg to be lifted into place (Fig. 2).

The trestle legs are welded latticed sections and, for 35-ft. height, are made up of three sections each 13 ft. long. The bottom leg section is fitted with a cone-shaped casting (see Fig. 3) which fits into a dish-shaped casting on the footing. The upper leg sections have a male splice at one end and a female splice at the other. A stub length leg section is also provided for special conditions. Each leg section fits the next snugly and is held in position by the insertion of a Bailey panel pin which locks the male and female components of the pyramidal connection. The angles of the legs are drilled with holes at 12-in. centres to accommodate the bearing pins of the transom. In the centre of each leg is found a wire cable for supporting the footing during launching. A trip hook is also provided to release the footing to allow tilting during salvage operations.

The winches (see Fig. 3) which are used to operate the legs and transom, are standard five-ton Beebe hand hoists with enlarged drums and are mounted on brackets with lugs to fit onto the leg holes at any given point. The power of these winches is multiplied by two twin blocks for transom operation.

A davit, which fits on the top of the legs, is provided to raise and lower the winches into position. Winch operator platforms are furnished which can be attached to the legs quickly at any required elevation.

The trestle footing is a steel grillage with steel bottom plate and removable mud claws (Fig.

Methods of Launching Wet Gap Crossings Using One Trestle

There are two types of launching procedure; the first by floating out the trestle complete on a pontoon raft and dropping the trestle legs down and guying the trestle in position; the second by hanging the trestle on the end of the Bailey Bridge and cantilevering the whole out, dropping the legs of the trestle when it has reached its desired position. For spans above 90 ft., it will be necessary to employ the buoyant action of pontoons to assist in carrying the nose of the bridge to its final desired position. After the trestle is set in

Fig. 8—The underside of the bridge supported on the trestle and rolling through on the rocking rollers.

Fig. 9—The bridge is shown completely launched and supported on two trestles; the transoms are not adjusted to level up the bridge.

its correct position, with all guys made fast, the transom is raised, releasing the pontoons. The Bailey superstructure is freed from the trestle, and rolling continues until the nose of the bridge reaches the far shore. The junction end post connection is now over the trestle. The bridge is then lifted on bridge slings operated by the trestle winches, the rocking rollers and junction links are removed and the male bearings are attached. Upon lowering onto the transom bearings, we have the span linked only at the bottom chord of the trusses with no moment resistance in the connection between the two spans.

Wet Gap Crossings Using Two Trestles

Following is a description of the procedure to make a crossing over water, using two trestles and three triple single Bailey spans.

A reconnaissance having determined a site where the distance from bridge floor to river bottom will not exceed 35 ft. the centre line is laid out and the approximate positions of the near and far bank seats established. The distance between the bank seats is checked and the approximate positions for the two trestles are located. Accurate soundings are made at these points and extended over a sufficient area to ensure that the river bed has no abnormal features such as pot holes or large boulders. The material of the river bottom is examined and the bearing value estimated. If necessary, the standard footing areas will be augmented to bring the bearing pressure within the estimated capacity of the river bed.

On the near bank, a site 12 by 30 ft. in plan is prepared for trestle assembly and erection. On both banks, dead men are placed for the trestle guys.

While the Bailey Bridge is being assembled by the bridge crew, the trestle crews place the four trestle footings at the proper centres at right angles to the bridge centre line. The transoms are placed in position on blocks with end gates open. The bearings, rocking rollers and leg lifting pulleys are put on the transoms (see Fig. 5). The bridge is then rolled forward until the nose of the bridge is as far beyond the far-shore trestle as the near-shore trestle is beyond the main rocking rollers of the Bailey superstructure.

The bottom sections of the legs of both trestles are now raised by hand, the legs of the far-shore trestle being attached to the top chords of the bridge trusses while those of the near-shore trestle are guyed to the ground. The transom end gates are closed and each leg is fitted with its two winches. The tackle is rigged for transom raising and the transom of the far-shore trestle is raised until the rocking rollers on it are in contact with the bottom chord of the bridge above. The transom is then attached to the chords of the bridge by means of suspension slings (Fig. 6). The footing cables are now attached, as are the leg-lifting brackets and cables. The diagonal struts are attached to each leg just above the footing with the opposite end attached loosely in a chain to the opposite end of the transom, the centre pin of the strut being placed in the correct hole for the water depth expected.

The winches on the downstream leg are rigged to lift the upstream leg. This leg is lifted until the footing is clear of the ground and a pin inserted above the transom flange to hold it in this position. The downstream leg is raised in a similar manner.

The bridge is now rolled forward carrying the far-shore trestle on its nose, as shown in Fig. 7. As the footings clear the shore, the mud claws are bolted into position.

In the meantime, two pontoon piers have been fitted up. As the rolling continues, the nose of the

Fig. 10—The bridge has been split and the end s of the two simple spanslowered onto the trestle bearings.

bridge with its trestle load sags until the trestle footings are sufficiently under water to allow the pontoon piers to be brought one each side of the trestle. Carrying beams are inserted which rest on the gunwales of the pontoons and are clamped in position. As rolling proceeds, the pontoons move along with the trestle until the increasing sag of the bridge brings the bottom flange of the trestle transom to rest on the carrying beams of the pontoon raft.

The rolling proceeds with the near-shore trestle still on shore. The diagonal guys from the near-shore dead men have been attached to the far-shore trestle and are paid out to control the nose of the structure and prevent it being forced out of line by the river current. During the rolling, the legs of the far-shore trestle are lowered, adding new leg sections as required.

Fig. 11—The complete bridge. The bridge is supported on the trestle and opened to traffic. Note the party on the pontoon near the trestle, taking electric strain gauges readings as the traffic passes.

The rolling continues until the far-shore trestle reaches its final position. This is determined when the second splice in the bridge superstructure is directly over the near-shore trestle which is still in its original position.

While the near-shore trestle is being attached to the bridge in the same manner as described for the far-shore trestle, except that wood blocks replace rollers between the trestle transom and the bottom chord of the bridge, the legs of the far-shore trestle are being lowered, the diagonal struts fixed in position and the trestle guyed securely. The transom is raised to level off the nose of the bridge. With the release of the suspension slings which tie the transom of the far-shore trestle to the Bailey Bridge and the raising of the footings of the near-shore trestle clear of the ground, rolling can be continued. The bridge rolls through the far-shore trestle carrying the near-shore trestle out toward its final position. (Fig. 8).

The rolling is continued until the first splice in the bridge superstructure is directly over the far-shore trestle transom. At this stage, the nose of the bridge will have reached the far-shore and is brought to rest on shore rollers (Fig. 9).

The legs of the near-shore trestle are now lowered and, after the diagonal struts are secured and the guys made fast, the transom is raised to level off the sag in the bridge.

Each trestle crew now lifts the bridge clear of the trestle transom by means of slings operated by the trestle winches. The rocking rollers and wood blocks are removed and the male bearings are attached and the bridge is lowered, so that the male bearings seat on the female bearings which are attached to the trestle transom.

While this is being done, the shore ends of the bridge are jacked up, rollers removed, end posts attached and lowered onto the bearings. Ramps and bridge floor are commenced. During these operations, the trestle crews remove the junction links in the top chords of the bridge over each trestle. This is accomplished by raising or lowering the trestle transom until moment in the bridge superstructure passes through zero at which time the pins of the links become loosened and are removed. (Fig. 10).

Again we find simple spans supported on the trestles with no moment resistance at any support.

Although the above procedure may sound very complicated as described in writing, it is in fact very obvious and straight forward to the men in the field as is witnessed by the ease with which a new trestle crew can be taught how to operate a trestle. Each trestle crew normally should consist of one non-commissioned officer and twenty-four sappers.

After a bridge of this type has been opened for traffic, the loads should be run up gradually to the maximum for which the bridge was built. Any settlement of the footings should be taken care of by adjusting the transom back to level by means of the winches. The guys should also be re-adjusted, tightened and checked. On major bridge crossings, a permanent maintenance party should always be on duty to make necessary adjustments, and keep approaches, ramps and bridge floors in good condition.

Dry Gap Crossings

A dry gap crossing using one trestle can be made by hanging the trestle under the nose of the bridge, letting legs down at desired position and rolling superstructure through the trestle to the far shore. The lifting power on the trestle transom is sufficiently great to raise the nose of the bridge, if necessary, as it approaches the far-shore.

If two trestles are to be used in a dry gap crossing, both trestles are hung under the nose of the bridge. At the proper point, legs of the near-shore trestle are lowered. The bridge with the far-shore trestle still attached, is rolled over the near-shore trestle. When the far-shore trestle reaches its position, its legs are lowered and the bridge superstructure rolled through both trestles until the nose of the bridge reaches the far-shore.

From this point, removal of rollers and splitting of spans over the trestles continues exactly as described for wet gap crossings.

Production

Throughout the design of the Canadian Universal Trestle one important fact was borne in mind: inasmuch as the trestle was to go into mass production, close tolerance must be avoided wherever possible. For example, the leg well in the transom is 17 by 17 in. while the leg is 16 by 16 in. and the transom pin holes are one-quarter inch larger in diameter than the transom pin. There are, however, a few places in which close tolerances were essential.

The transom is, as has already been stated, composed of two half transoms, spliced with a male-female splice in each of the four chords (See Fig. 2). At these splices, allowance is made for camber, but naturally it is important that as little play as possible be present. The splice connection was therefore designed with pins and holes of standard Bailey dimensions. If an end view of the box section is imagined it will readily be seen that the relative spacing of the four splices must be very closely maintained in order to allow all half transoms to be interchangeable, and four pins to be inserted in the assembly of any pair.

Since the whole section is of all-welded construction this involves the use of considerable care in the fabrication of the transom.

The procedure in the fabrication of a half transom was dictated to some extent by the available drilling machinery. The first step was to cut the material and punch holes in the chord angles at the points which would later correspond to the chord splice holes. These holes were then sub-drilled.

Since it was found that diagonal welding between web members of the side of the box section induced considerable warping, it was decided to do the diagonal welding in the vicinity of the splice before completing the drilling of the splice holes. With sub-drilled holes in all members at the female pin holes, the next step was to fabricate completely but separately each side of the box. A jig was used for each of these operations. Next, the cross bracing diaphragms were made up individually, and the whole box assembled in a jig designed to prevent warping during this process. The complete box section was now placed in another jig, supported on pins through the sub-drilled holes in the chord members, and the remaining parts of the male and female splices welded in place. This jig assured that all four splices would be exactly the right relative position on all half transoms so that all would be interchangeable. At this point, the final pin holes were drilled, the exact spacing centre to centre of holes being maintained. The holes were then reamed, before removal of the jig.

The second case in which close tolerances were required was in the leg splice. This splice was a completely internal one, to enable the leg to slide up and down through the transom. Also, the splice had to carry tension, compression and bending. As described earlier, the splice consists of a pyramidal nose (See Fig. 3) fitting into a corresponding opening, and held in place by a Bailey pin. In order for the splice to take compression, the angles of the leg had to butt; in order to permit tension, the pin had to fit snugly; in order to take bending, close fits were essential at both the base and the apex of the pyramid. Another point in connection with the leg was that, since the total length of leg was considerable, twisting due to welding had to be kept to a minimum so that when the transom was raised or lowered through its full travel no binding between legs and transom well would occur.

The procedure in the fabrication of the leg section was as follows. The angles were cut to length with allowances for later facing both ends. Holes for transom pins were sub-punched in one leg of each angle. The four angles and the diagonal bracing were then assembled in jigs, and straightened and trued after each stage of assembly. The female splice was then put in place, using a master jig which resembled a male splice. Next the pyramidal male splice box was separately made in a jig and then assembled with the leg section proper after the latter had been faced at both ends. Now by means of a drilling jig, all the pin holes were accurately reamed to size and spacing required. This procedure made all top legs completely interchangeable so they would fit each other and all bottom legs.

The winch frame was designed to hang on the legs, by means of lugs fitting into the pin holes in the legs, as shown in Fig. 3. Since the blocks and steel rope exert a pull of some 20 tons, it is essential that the winch frame fit snugly against the leg, and that all lugs carry their share of the load. This too involved careful assembly in a jig. It is worth noting, in passing, that the winches were of standard design with a capacity of five tons, but fitted with extra large drums in order to provide the required length of cable without having more than two layers on the drums, because it was found that the heavy pull caused a third layer to bite into the other layers. The double pulleys were also especially designed, with 8-in. sheaves and safe capacity of 20 tons.

All the steel fabrication on the Class 70 prototype, and the Class 70 production models was done by the Dominion Bridge Company. In the large scale of production, the facilities of the Ottawa, Toronto and Montreal plants were used, certain parts being produced at each plant and the whole being assembled for shipment at the Ordnance Depot. All the inspection at the three Dominion Bridge Company plants was carried out by the Inspection Board of the United Kingdom and Canada, in close co-operation with the Directorate of Engineer Development.

Conclusions

From the above description of the development, design, testing and production of the Canadian Universal Trestle, it will be seen how Canadian inventiveness and engineering skill, together with Canadian production experience, have combined under the guidance of official military control to produce an extremely useful and versatile addition to the bridging equipment of the British and Canadian Army.

A patent for this new equipment has been applied for on behalf of R. C. Manning.

THE MANUFACTURE OF PROPELLERS FOR 18″ TORPEDOES

Some Notes on Methods Developed in Canada

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

Much has been written of the large and varied Canadian production of guns, shells, tanks, aircraft and other war material, but it may not be realized that Canada has also contributed to the war effort in the manufacture of several under-water weapons and protection devices. Of these, the modern torpedo is undoubtedly the most complicated, and from the engineering point of view the most interesting of them all, and though the whole assembly has not so far been undertaken here, most of the complicated mechanism (including the engine) was manufactured in Canada for shipment to England where it was built up into complete torpedoes.

In this article an attempt will be made to describe some specially interesting operations in the manufacture of the propellers, but first it may be as well to indicate in general terms the construction of a modern torpedo, with particular reference to the 18-in. variety which happened to be one of the types for which Canada made several of the major components.

The 18-in. Torpedo

This torpedo was designed and developed some years prior to the war, largely for the purpose of pressing home attacks on warships and other vessels from the air. Its first spectacular use during the present war was in the famous attack on the Italian fleet at Taranto, Italy, in 1941, when a large number of enemy vessels was incapacitated. It is noteworthy, also, that in the sinking of the Bismarck, 18-in. torpedoes, launched from planes, were used with such effect that the vessel was badly damaged and slowed down, thus permitting heavy surface craft to get within gun range.

At the conclusion of its run the " fish " is designed to sink to the bottom of the ocean so that it does not become a menace to allied or neutral shipping; (unlike, by the way, enemy torpedoes which are not thus thoughtfully designed). When equipped with a practice or " blowing " head for trial purposes, however, the mechanism is arranged to do just the opposite function, i.e. to bring the torpedo to the surface so that it can be recovered and towed into port.

The Main Construction

It has four main sections: starting from the front end, we find, first, the warhead filled with high explosive and housing the primer. Next, the air vessel on which the engine depends for its air supply during the run, and coupled to a " balance chamber," housing the depth gear, fuel and lubricating oil bottles and many other fittings and valves. The air vessel and balance chamber, by the way, together comprise a second main unit known as the " forebody ".

The third principal section is the " after-body " which consists of an engine-room and buoyancy chamber. The engine room contains, besides the four cylinder radial type engine, a considerable mass of smaller components and valves, all so closely packed together that it is difficult to imagine how they can possibly be assembled. In the second half of this main section is located the buoyancy chamber containing, amongst other components, the gyroscope which keeps the torpedo on its course and the driving shaft from the engine. Finally, there is the tail unit which houses the main shaft extension, the twin propellers in line, the gearing which reverses the direction of one of these and a sleeve shaft for transmitting the reversed load to the second propeller. There are also located here the horizontal and vertical rudders for controlling depth and direction respectively and the rudder connections. It may be asked, why two propellers? This is necessary to produce a balanced torque and to prevent the " fish " from rotating during its run, thus upsetting the depth keeping gear and many other vital functions.

The Principal Components

Dealing briefly with some of the main components, the air vessel is a machined hollow forging which is

Fig. 1—Blocking dies.

Fig. 2—Finishing dies.

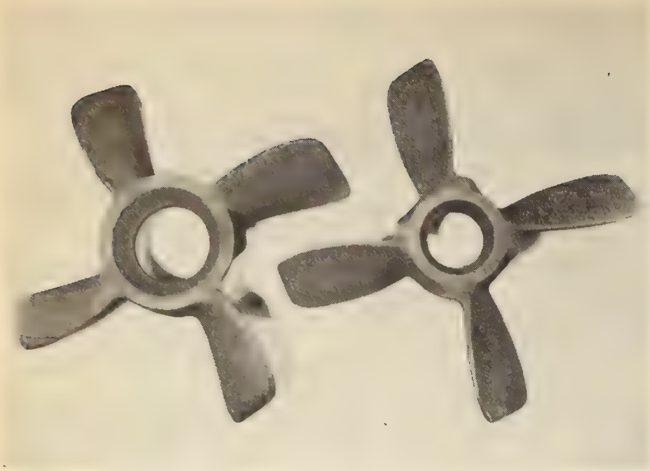

Fig. 3—Final appearance of both blades as forged.

filled with air at a high pressure before the run. This supplies air through reducing valves for the combustion of the fuel oil and also for operating the rudders, gyroscope and forced lubrication system. The engine is of very special and compact design, developing a remarkably high power for its small size and weight.

A gyroscope is driven by compressed air at a high speed and controls the direction of the torpedo through a sensitive relay system coupled to the vertical rudders. An interesting feature is a device which can be adjusted by the pilot before the " run-in " so that whatever the direction of the plane (and hence of the torpedo when it hits the water), the torpedo will assume a predetermined course.

The depth gear operates the horizontal rudders, and, in order to avoid oscillation during the run, is designed to act under the combined influences of water pressure and the inclination of the torpedo

Fig. 4—Illustration showing the set-up for hub machine.

itself. It incorporates a number of compensating devices to take care of special conditions such as may arise when the torpedo plunges deeply on release, subsequently breaking surface. The slight movements of the depth gear are stepped up with sufficient power to control the horizontal rudders of the torpedo by means of a servo-motor.

Besides these main items there are many valves and other components to describe whose function and construction would necessitate the compilation of several large volumes. All involve knotty engineering problems, and all have been developed as a result of years of experiment and research.

The Propellers

With this somewhat sketchy background, let us turn now to the propellers which have the vital function of driving this monster through the water at nearly fifty miles per hour?

In a torpedo, considerations of cost are subservient to accuracy, speed and hitting power, which in turn necessitate the last ounce of efficiency from every part. This factor, in conjunction with the small dimensions, means that the propellers have to be accurately machined to close tolerances all over; in which respect they differ from their larger counterparts used for

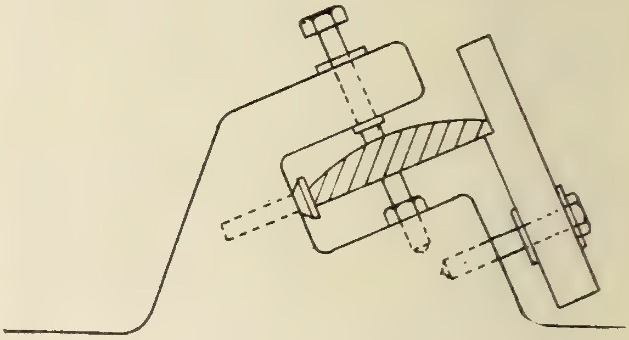

Fig. 5—Detail view showing clamp.

the driving of ships. A few thousandths of error here or there in the propellers would make no appreciable difference to the speed of a tanker or passenger liner, whose screws are usually cast, then rough machined and trimmed by hand; not so with the torpedo.

Moreover, it must be realized that torpedo propellers have to withstand the shocks of launching and accidental contact with underwater obstructions. For this reason, cast material is out of the question and forgings of high tensile nickel-chrome steel are essential. The two propellers are both of true helical design and proportioned so as to provide exactly equal turning moment when running in line in the torpedo. The helices are set in opposite directions and the forward propeller is somewhat smaller in diameter than the " aft " propeller.

Both propellers have four blades and are set on bosses having taper bores.

The Problem

The manufacture of such a complicated shape to fine limits is not to be lightly undertaken, and Genelco (operated by Canadian General Electric Company Ltd.) very wisely investigated as many established methods as possible before setting to work. They adapted some of the best ideas of those which were presented to them, and have on their own account developed methods which, in many respects, are considered to be the most advanced seen by the author. In particular, the finishing operations deserve special mention as it is in them that the firm have shown the greatest ingenuity in overcoming the serious lack of skilled labour which existed at the time in the Peterborough area. Operations were mechanized and rendered "fool-proof" as much as possible and were so controlled that a minimum of skilled hand-fitting and rectification work was found necessary.

The Sequence of Operations

The start of manufacture is the production of a forging which more or less closely approximates the finished shape. In England a hand forging is employed, whereas, in Canada and the United States, more use is made of drop stampings (produced in two or more stages). With the latter, of course, it is possible to provide a more uniform forging and to arrange so that less metal has to be removed during the subsequent machining operations. Both considerations greatly help to reduce the machining time, but, on the other hand, the production of the complicated drop forging dies takes several weeks. At Genelco Ltd., use was made of drop forgings manufactured by the Dominion Forge & Stamping Co. Ltd., Walkerville, Ont. Figures 1 and 2 show a set of blocking dies and a set of finishing dies respectively. Bearing in mind that there

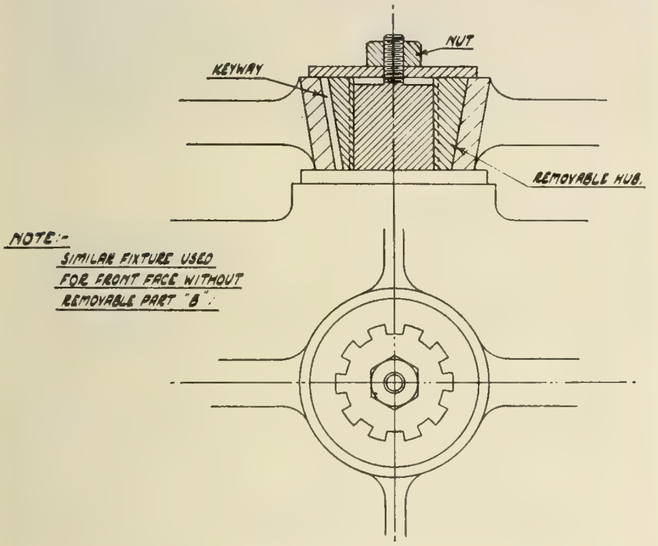

Fig. 6—Holding fixture for machining back face.

are two completely different propeller shapes and that, besides the forming, there are also various stripping operations, it may be seen that the manufacture of the forgings for this production is in itself no mean engineering feat. Figure 3 shows the final appearance of both blades as forged.

Dealing now with the machining operations, these usually commence with the turning of the hub surfaces, which are generally performed on vertical turret lathes, though at least one manufacturer in the United States has made extensive use of the horizontal turret lathe for this purpose. At Genelco Ltd., a 36-in. Bullard vertical turret lathe was employed for the hub machining which follows preliminary operations of milling away excess metal on the forging and marking out centre lines on the driving faces of the blades. Figure 4 illustrates the set-up, and Fig. 5 shows the special clamping fixture which enables the propeller to be accurately levelled to the centre lines, and, at the same time, holds the four blades rigidly

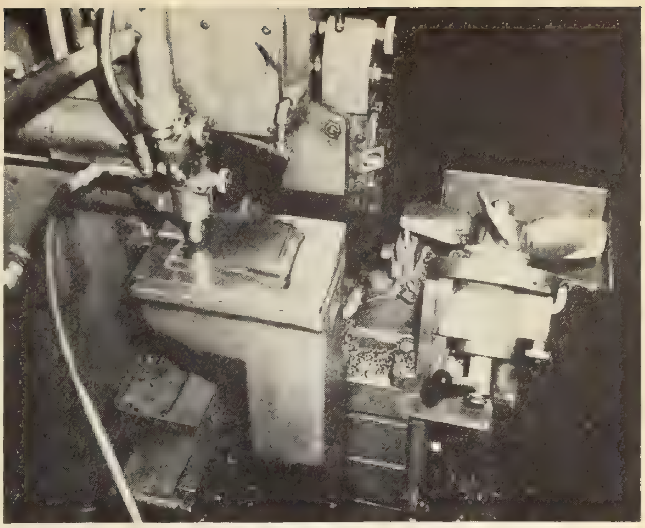

Fig. 7

so as to permit rough cuts in the bore. A Carboloy tool was developed to give a good finish in the bore, using high speed and fine feed. An interesting point is that Genelco completely finished these turning operations on one setting with two cuts. At most factories, it has been found advisable to rough machine the propellers *all over* before proceeding with the finishing cuts so as to avoid distortion of the thin sections. Due possibly to the use of more carefully heat treated forgings, or by the more careful use and design of holding fixtures, this was not found necessary in respect of the hub at Genelco. One hour was required for this operation, including marking off.

Broaching the keyway followed normal lines and required only two minutes, being followed by the interesting operations of shaping the front and back surfaces of the blades. Two main methods are in use for this operation on British and American propellers: the duplicator type of milling machine (Keller, Hydrotel and so on) and the shaper. An advantage of the Hydrotel is that part of the hub can be machined at the same setting, and the author recalls a set-up in an English factory where the hubs and blades of no less than six propellers were machined at a time from a single master block. In this case, front and back surfaces of two blades

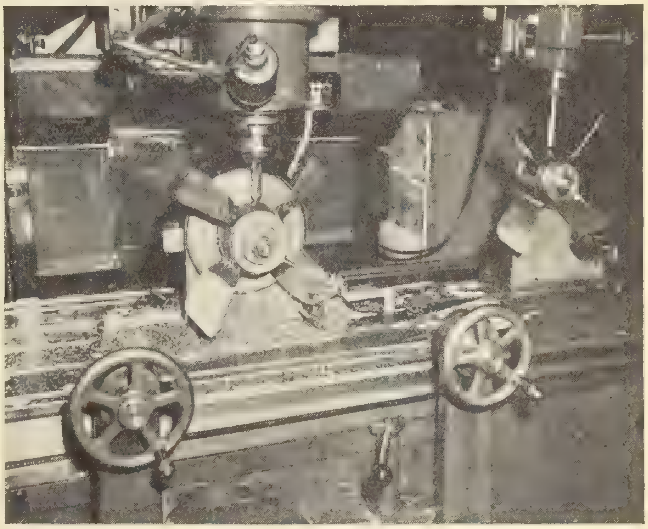

Fig. 8—Operation on a large blade.

together with the quadrant of hub bounded by them were machined in one cut, after which the six propellers were indexed around for the next pair of blade surfaces.

On the other hand the use of shapers enables much more rapid cutting of the blade portions and at Genelco, shapers were used for the blade and duplicating millers for the hub and root, thus combining the advantages of both systems, though more operations became necessary. Four Rockford hydraulic shapers were suitably equipped, one for each of the four types of blade surfaces of the two sizes of propeller. They all had hydraulic duplicator heads and were each fitted with a master block which was a replica of one of the propeller surfaces. The stylus controlling the vertical movement of the shaper head travelled over the master block, thus causing the cutting tool to reproduce the shape of the blade on the forging. The operation was carried out in two cuts—roughing and finishing, each machine being equipped with an indexing fixture so that all blades could be readily machined at the same setting. In the case of the back face, a special removable hub was provided on the indexing fixture so that loading and unloading could be quickly

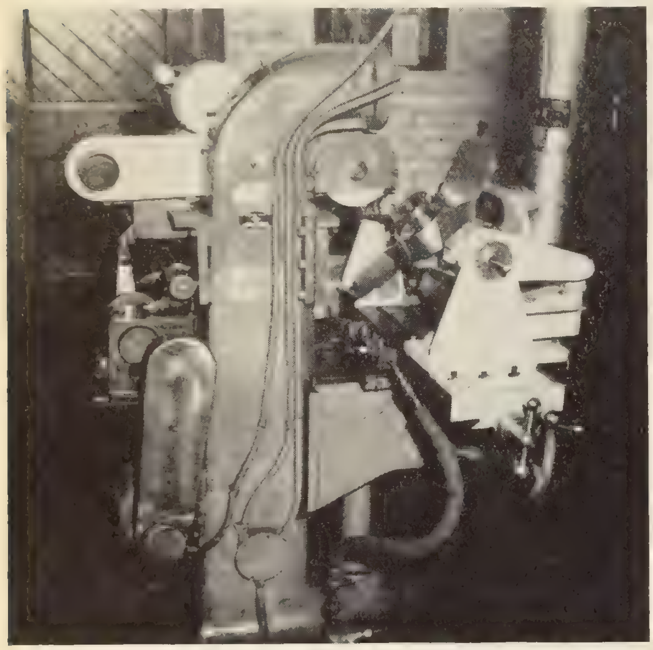

Fig. 9—"Index" vertical hand milling machine.

carried out (see Fig. 6). Figure 7 gives a good idea of the set-up. Note the spring loaded pin bearing against the under side of the blade which can be locked in position.

This pin provides rigid support during heavy cuts, but does not in any way impede loading and unloading. About .010 to .015-in. is left on each face after this operation for subsequent removal by grinding. The time taken for shaping was 38 minutes for the front face and 47 minutes for the back face, with girl operators.

Following the shaper operations, the complicated curved surfaces formed by the root of the blades and the outer diameter of the hub were next machined on a Keller Duplicator for the small blade, and a Cincinnati Hydrotel for the large blade, taking 93 minutes per propeller. Figure 8 shows the operation on a large blade. In both cases the operation is performed in one cut (no roughing cut was found necessary owing

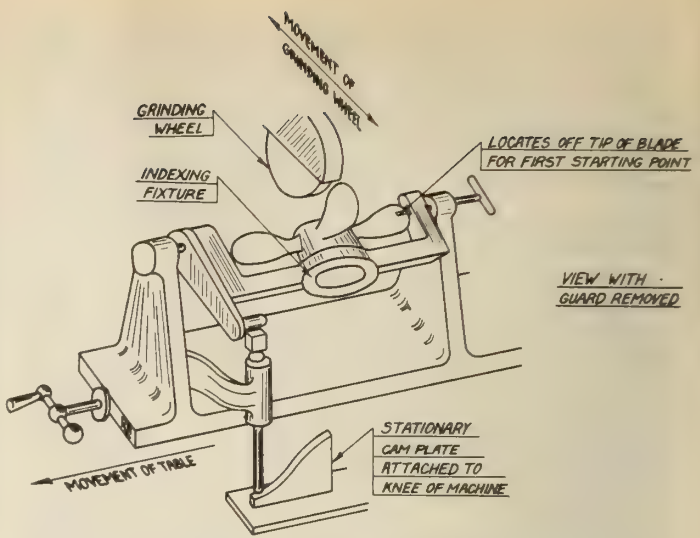

Fig. 10—Illustrating the principle of the machine which incorporates a half horse-power, 3,600 r.p.m. motor, driving the 6 by ¼ in. standard grinding wheel.

to the success of the subsequent mechanical grinding operations).

Then comes the profile milling of the blade edges, using two Pratt and Whitney profilers with extension columns to provide sufficient height to clear the fixture and propeller. This was a straightforward operation, each blade being indexed around in turn. This operation took 56 minutes.

An incidental and rapid hand grinding operation is inserted at this stage to blend the trailing edge of the blade into the hub face. Had production not come to an end, no doubt the preceding operations would have been so modified as to render this unnecessary.

At this stage, the propellers are completely machined all over as accurately and with as smooth a finish as is possible with cutting tools, but not by any means sufficiently finished for Admiralty requirements as concerns the blade surfaces and outside of the hubs. Normal procedure from now on, as witnessed by the author in a number of plants, would have been to hand chip, file or buff by means of buffing spindles until the blade surfaces fit master " bedding " blocks. As might be imagined, such operations require a good deal of skill and time, and, at best, there is a certain amount of spoilage due to undercutting. Knowing that

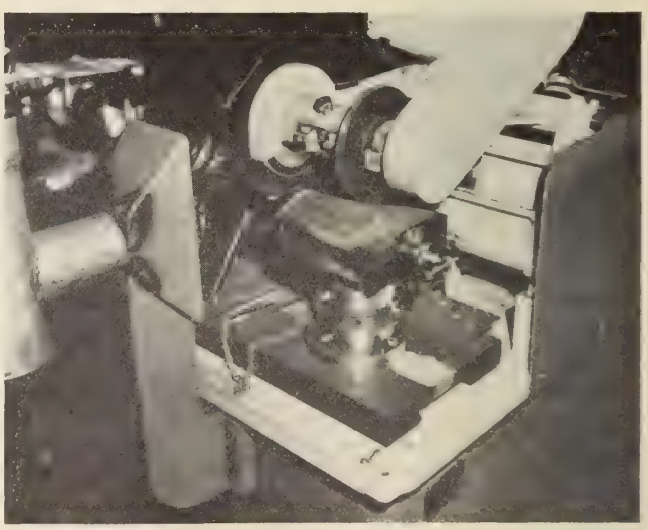

Fig. 11—Illustration showing specially built grinder.

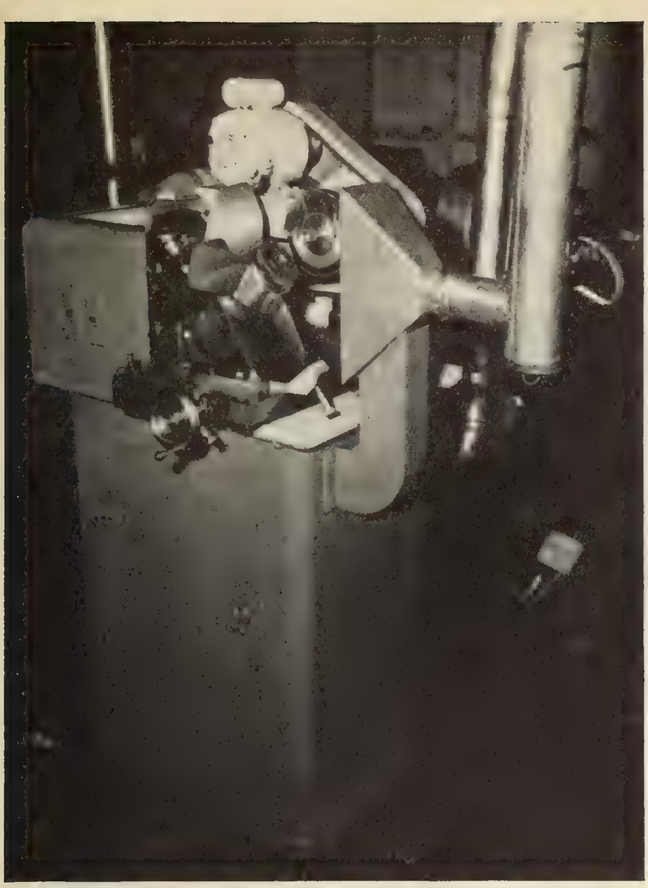

Fig. 12—Another view of the specially built grinder.

skilled help was at a premium in Peterborough, Genelco Ltd. planned from the start to eliminate all such hand fitting work, and, in the absence of any commercial machines suitable for the purpose, set to work themselves and designed and made a series of very ingenious mechanical grinding machines to take care of the various surfaces.

The first of these was adapted from an "Index" vertical hand milling machine as illustrated in Fig. 9, and was used for rough grinding the front face of the propeller. Figure 10 illustrates the principle of the machine which incorporates a half horse-power, 3600 r.p.m. motor, driving the 6 by ¼ in. standard grinding wheel. In the machining of each blade, the wheel travels across the blade face in a horizontal plane, and the necessary twist for each cut is provided by a rotation of the cradle. All this is done automatically

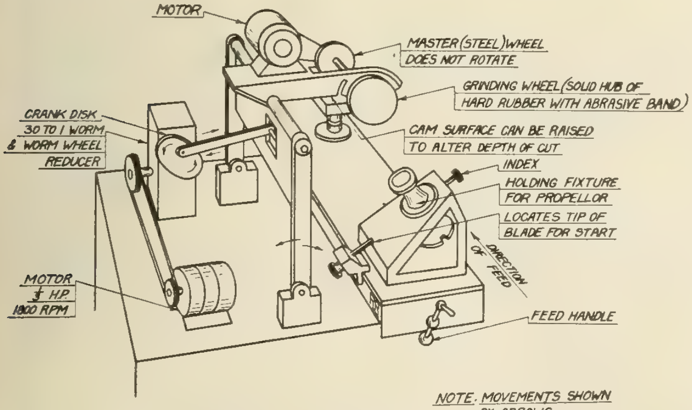

Fig. 13—Illustration showing how the movements of the stylus wheel over the master plate are achieved.

by the operation of handle 'X', but it should be noted that the machine is unable to finish the driving faces exactly, owing to the fact that the grinding wheel can only sweep in a straight line instead of on the helix which is desired. The time for this rough grinding is 60 minutes with a girl operator.

No more work is done on the driving face for the moment, the sequence passing to the back face which is completely finish ground in one operation by means of the specially built machine illustrated in Figs. 11 and 12. Basically, this method consists in reproducing the motion of a wheel moving over a master blade surface or copy plate. The master wheel does not rotate and its movement is given to a rotating grinding wheel which is mounted on the same spindle. The photograph does not show how the movements of the stylus wheel over the master plate are achieved, and an attempt to illustrate this is made in Fig. 13. The indexing fixture shown enables the propeller to be locked in the exact position for each blade to be machined in turn.

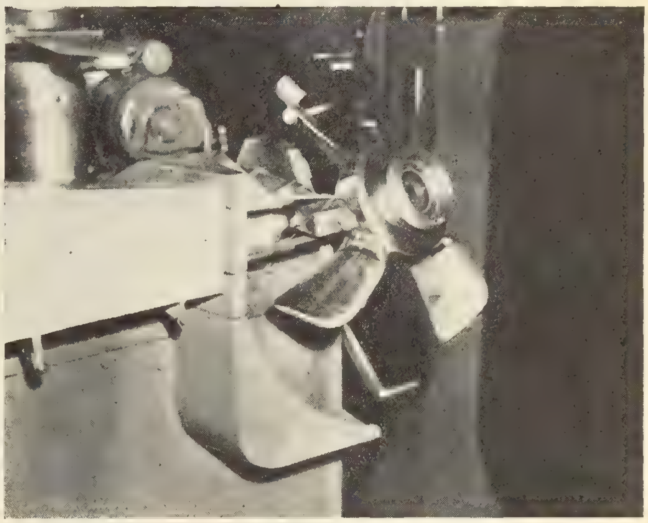

Fig. 14—Showing a close-up of the arrangement which involved the use of a ¾ by 48 in. abrasive belt driven at 5,000 surface feet per second and travelling over a rubber surface roller, 1.8 in. in diameter.

It will be observed that, with this method, the accuracy of grinding entirely depends on the copy wheel and grinding wheel remaining exactly the same size, and rather than have a series of copy wheels to accommodate different stages in wheel wear, Genelco worked on the idea of keeping a constant master wheel size and maintaining a practically constant size of grinding wheel. To do this, they developed a composite wheel with a moulded rubber rim on which could be quickly attached or removed an abrasive belt (known as a "Spirabelt" and made by Durex Abrasive Ltd.). The belts were 6 in. outside diameter, ½ in. wide and a push fit on the wheel. Besides being a good fit, the centrifugal force at 5000 r.p.m. was sufficient to ensure that there can be no slipping. The life of each "Spirabelt" naturally depended on the amount of metal left from the previous operation (.010 to .020 in.) and appeared to average about one belt for two blades—though one belt often finished the whole propeller. Though the description sounds a little complicated, it was found in practice a simple enough operation to employ girl operators, with whom a time of 75 minutes per propeller was obtained.

The propellers were now finished as to the back faces

(Continued on page 518)

WARTIME EQUIPMENT RESPONSIBILITY OF THE ROYAL CANADIAN CORPS OF SIGNALS

(Abridged)

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FOREWORD

In a speech at Toronto before the Trades and Labour Congress, the Minister of Reconstruction said:

> "The War has demonstrated that Canada is dependent upon outside sources for too many components of our finished products."

This, very briefly, sums up the wartime problems of the Canadian radio and electronic industry and reflects in great measure the difficulties which faced the service as well as the industrial engineer.

The avenue of approach in the post-war era to Canadian military as well as civil expansion of research and development facilities is indicated clearly in the remarks of the Honourable the Minister.

The full story of Canadian industrial achievement in the communications field will follow after the war, when it will be no longer necessary to keep the secrets of research and development. In the meantime it is possible to throw some light on the engineering care which has been devoted to this aspect of army signals. While its work is only a small part of the total Canadian engineering endeavour, the Royal Canadian Corps of Signals is by far the largest army communications organization ever assembled in Canada.

In this article no attempt will be made to outline the operational accomplishments of the Royal Canadian Corps of Signals in the field army. Such an account must be left to those qualified by battle experience to describe the communications problems which confronted our forces at Dieppe, on the shores of Sicily, at Caen, at Calais, and in the many actions where Canadian troops have proved their worth. However an attempt will be made here to deal with some of the problems which had to be solved, and the steps which had to be taken, to ensure that Canadian-produced army signals equipment would be as electrically reliable and as mechanically robust as that produced by Britain, the United States, Russia or Germany.

Prior to the gathering of the war clouds in 1939, the efforts of the engineering branch of the Royal Canadian Corps of Signals had been directed:—

(a) To engineer the fixed Army Signal networks vital to trans-Canada, coastal and Empire defence;

(b) To engineer the communications (including submarine cable links) for Atlantic and Pacific Fortress Commands:

(c) To plan for meeting the complex needs of Signal Units should Canadian troops be required to take the field.

Immediately before the war much had been done to link National Defence Headquarters by wireless with:—

(a) All Military Districts and the larger training centres;

(b) The Atlantic and Pacific seaboard fortresses;

(c) Certain outlying strategical centres of the North-West Territories in the vicinity of the great circle route to the Orient.

Immediately following the outbreak of war, all Canadian Military Headquarters, as also the War Office and the British Ministry of Supply in the nerve centre of the Empire, were linked with National Defence Headquarters.

Primarily intended to take over in case of sabotage to the home telephone, telegraph, teleprinter and trans-ocean cable networks, these links have since been expanded to supplement the commercial facilities attempting to meet the sky-rocketting demands of a Canada at war. Incidentally, these links, which provided training fields in peace, produced many of the "key" wireless operators and technicians who went overseas with the early Canadian Divisional Signals. The Royal Canadian Corps of Signals trans-Canada wireless network also existed in peace-time, and provided a training field for signals units of the Non-Permanent Active Militia. Many divisional officers, wireless operators and technicians at present overseas gained their early knowledge of military signals equipment while serving as members of this voluntary organization.

In 1939, the task of placing signals wireless and line equipment in the hands of Canadian troops about to proceed overseas was the major problem confronting the engineering branch of the Royal Canadian Corps of Signals. To do this required the proving of thousands of individual items of stores, ranging from telephones, field telephone cable, batteries and vacuum tubes (now so difficult to procure for the broadcast receiver) to heavier equipments such as electric lighting plants and complete wireless telegraph and telephone sets. These varied in size from portable lightweight infantry sets to the heavier medium powered tank and vehicle sets essential for brigade, division, corps, army and army group links. It was necessary to provide for the bonding of the electrical systems of tanks, wireless vehicles and staff cars, as well as the suppression of the electrical "noises" of the ignition systems and every electro-mechanical device contained therein. This task called for the supervision of the installation details, the provision and the "suppression of the portable battery charging plants so that wireless sets when installed in tanks and vehicles, irrespective of the radio frequency assigned or the speed of the motors, could be operated over identical ranges in miles as readily on the move as when stationary on the roadside." The provision and waterproofed packaging of the proper quantity of spares to accompany these stores was undertaken; the test apparatus necessary to maintain them was provided. Finally it was necessary to examine every report from the field giving any clue to electrical and mechanical weaknesses for correction in later production.

The complexity of an engineering task of this magnitude was immense. It is not claimed that Canadian produced signals stores attained perfection. Sound engineering consciousness of the necessity of high standards for signals stores was not confined to Canadian engineers, in fact British signals design authority had always laboured earnestly towards this end. But, the Canadian service engineers had much to offer from their own experience. They realized from the start that it would be futile to allow stores manufactured to Canadian and American broadcast standards to be placed in the hands of the troops. Their experience, moreover, was based on the operation and maintenance of wireless and line fixed stores under high and low temperature extremes which are not generally encountered in most parts of the Empire. At the same time, Canadian industry and public utilities had maintained touch with the overall signals stores operational requirements through the active participation of their personnel in the activities of Non-Permanent Militia Units of the Royal Canadian Corps of Signals.

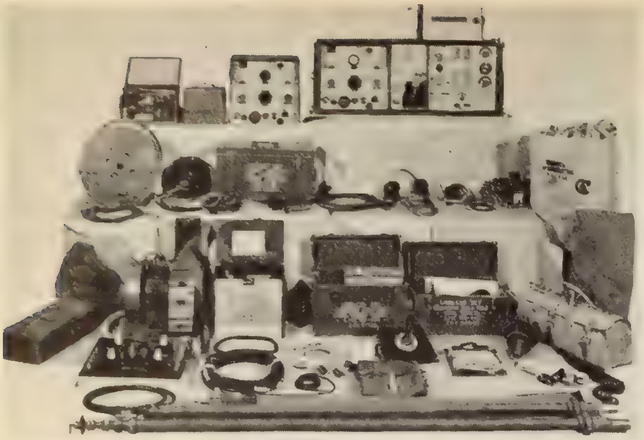
Canada was not called upon to undertake the manufacture of other than normal British designed signals stores until after the fall of France in 1940. Up to that time the overseas units of the Royal Canadian Corps of Signals had anticipated the early provision of specialized requirements of British patterns from British stocks. This was in accordance with Commonwealth co-ordinated policy of pre-war standing. Nevertheless, one commercial wireless set of Canadian manufacture had already been pressed into overseas service. Other types from Canada, as yet undeveloped, were now urgently required.

This call from overseas for the mass manufacture of specialized stores compelled a revision of the General Staff appreciation and a reversal of the home policy of design. It had always been taken for granted that samples of all British stores would be provided for copy in Canada, complete with specifications and drawings. Invaluable assistance had already been obtained on many stores which merely required conversion from British to Canadian processings in terms of Canadian and American practices and components. This assistance, however, had not been forthcoming in the specialized stores. It is now known that the winning of the battle of Britain was largely due to the concentration of British radio and electronic engineering effort on radar development during the critical period. A great responsibility therefore fell upon Canada in that crisis and the Dominion assumed a heavy share of the communications burden.

One immediate solution appeared to be to adopt specialized stores of U.S. Signal Corps pattern. A precedent existed, for the United Kingdom was already doing this wherever possible. Demands, in addition, were being made on U.S. industry for "off the commercial shelf" stores. Actually many stores of U.S. Signal Corps patterns were acceptable and many were procured, although, in consideration of certain tactical requirements, such as the radiated power outputs (range in miles) and the channel frequency assignments for the ultimate British role, there were preclusions in the wireless field. The Canadian army overseas was destined to fight alongside British armies. Therefore, no devations from the considered long-term policy of co-ordinated operational wireless planning, particularly in the communications roles of armoured corps and infantry, could be considered.

There was now little time to be lost. Most of the peace-trained service engineers of the Corps, as well as many industrial engineers, had already proceeded overseas with Divisional Signals where there was great need. But the need at home had also become greater than anticipated. It was therefore vital to plan the development programme and to hasten the expansion of manufacturing facilities. Young service-trained engineers of proved ability were required for the Army Signals Research and Development Establishment. As none could possibly be spared from overseas, a number were withdrawn from the reinforcements (in many cases much against the grain of patriotic desire). Electrical and mechanical engineers as well as radio technicians were sought from other sources, but great care was taken to divert as few engineers as possible from the experienced ranks of the expanding electronic industry. A great deal of research had now to be accomplished before models could be submitted for final approval.

It has been said that Canada should never have embarked upon such a programme of specialized development, despite the pressure of total war emergency. True, there were handicaps. Few engineers possessed communications experience plus design talent. In peacetime our radio and electronic industry had been largely dependent on outside sources for design skill. With the advent of war, the demands of the three Services and of industry for experienced engineers and technicians far exceeded the supply. Many of our graduating engineers had been attracted to foreign fields where they could earn more adequate reward. Moreover, the opportunities at home for employment in the electronic field were fewer than those in hydro and general electrical engineering pursuits. In point of fact, few of our Canadian universities, prior to the war, offered other than partial communications engineering courses. Further, our radio and electronic industry had been largely dependent



Wireless set Canadian No. 9 Mk1: general view of complete station.

upon foreign development facilities, particularly for the supply of highly specialized processings. This gave rise to a most disheartening problem. Great premium and priority was placed on radio and electronic development resources in the U.S.A., particularly after Pearl Harbor, so that in many instances, the development of signals stores destined for the Canadian army overseas came to a complete standstill owing to the low priority accorded army development in the face of inter-allied navy, army and air radar and signals commitments. Another very serious handicap was the low priority placed upon specialized electronic test equipment essential to research and development—practically all of which was processed in the U.S.A.

The ocean separated us from those in the field forces whose advice was needed in order to clarify the users' requirements, and to guide in the final designs, on which so much depended. Therefore, when one reads the production records of 1943-44, which dwarf all peace-time peaks, the significance of the development period, 1941-42, should not be lost. Undoubtedly, development was time-consuming.

On the other hand, the difficulties of production should not be under-estimated. Not until 1942 was a production branch established to deal solely with the production of inter-service signals stores. Then, when its organization reached the point where the branch could be of value conditions were unfavourable for the obtaining of the required staffs. Delay was also caused by the low priority which was accorded to the components required for the manufacture of inter-allied army signals stores in comparison with the preferential treatment which perforce in the days of 1941-42 had to be given to navy and air commitments. Many ordinary components were not even produced in Canada, while elsewhere the demand was greater than the supply. Industry, therefore had to be expanded to handle abnormal calls for ordinary components, as well as for the more critical components which had never been manufactured in Canada, such as many types of miniature and power vacuum tubes, quartz crystals, specialized meters, dynamotors, etc. Little was known at that time of the need which would arise later for Canadian conservation programmes to ensure economic allocation of critical metals such as cadmium, aluminium, zinc, copper, tin, chromium, nickel, and critical components such as rubber, phenolics, polystyrene, polyvinyl, and cork, teakwood, etc.

Notwithstanding all these handicaps, the task of manufacturing specialized electronic stores in addition to the thousands of odd signals stores is being achieved. Much credit is due to Canadian industry. Without that industry's technical knowledge, its British and American engineering affiliations, its experience during peace in the field of " small order " mass production, and its appreciation of the difficulties facing inexperienced service engineers, much of our endeavour to attain the highest possible engineering standards would have been in vain.

The main purpose of this article is, however, to indicate steps which were taken to ensure high standards of engineering performance in the specialized stores provided for the fighting forces. Industry is informed of the operational requirements for a wireless or line store by means of an engineering specification, which expresses, in contractual form, the actual performance expectancy of the fighting forces. A performance equivalent to two years' continuous wear and tear, with the minimum of maintenance and repair over that period, is usually required. Moreover, this performance must be had in spite of the subjection of the stores to the abuses of rail, steamer and road transshipments, vibration in vehicles and bumps in tanks, shock from gun discharges and exploding shell, exposure to extremes of heat and cold, to moisture, to the accumulation of sand particles and to fungus growth. It will be readily appreciated from casual inspection of its construction that even the most expensive broadcast receiver procurable during peace could not possibly stand up to such treatment. It was the responsibility of the service engineer to ensure, by proper clauses in the specification, that tests should be made, so exacting as to prove the acceptability of the store as regards such matters of electrical and mechanical safety and durability. Industry picked up the challenge accordingly and signals service engineers of the Inspection Board moved in to conduct the required tests during and after manufacture. In certain cases the factors of safety stipulated were found to be impossible of attainment in production. Compromise was necessary. In other cases, with the consent of and often at the suggestion of industry, standards were raised.

In the design of wireless sets, service engineers strive for the maximum of power output (range in miles) consistent with minimum power input, overall weight and maintenance. By early Canadian recognition of the values of " miniature technique " for infantry wireless sets, it was found possible to provide the same frequency coverage and power output with substantial savings in overall set weight and dry battery drains—thereby saving the consumption of dry battery ingredients which are in most critical supply. Similarly, by careful study of circuit design, the same frequency coverage and power output was found possible for the heavier sets with substantial decreases in storage battery drains.

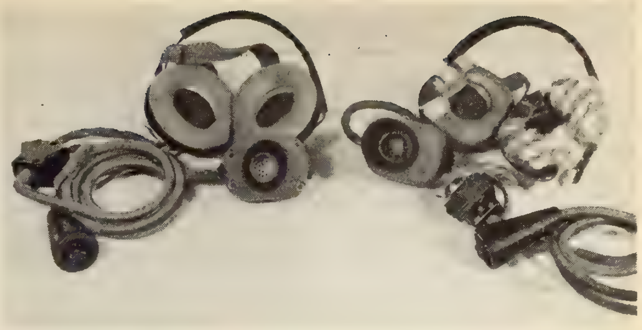
The adequate supply of essential stores at a fighting front obviously has much to do with the winning of the battle. Therefore, those factors are vital which, without impairing performance, serve to reduce the bulk and weight of stores. For example, thousands of dry batteries for infantry wireless sets move forward daily. If their weight can be halved without impairing performance, there follows a marked saving in military and civilian labour and loading space. If the hundreds of higher powered wireless sets operated by storage batteries save ten per cent in power input without impairing performance, there is a reduction in the amount of gasoline moving forward daily to brigade, divisions and army headquarters, with corresponding savings in the wear and tear on battery charging plants. Reports confirm that Canadian-developed wireless sets perform well in the abovementioned respects.

The appendix to this paper contains some technical notes, based on service experience, dealing with precautions to be taken in order to ensure the serviceability of specialized stores as issued to the fighting forces.

On the other hand, signals officers of the fighting forces do not always see the "rosy picture" of the design effort as it appears to the service design engineer. In general, their criticisms have been confined to the ruggedness, to the ease of operation and maintenance, to the accessibility of the store and to comparisons of weight. Wireless sets gain favour with them when they "punch through", weigh less and save battery power. Again, the fighting forces are greatly concerned with the amount of mutual interference caused by two wireless sets which are near together. In such cases, it is the duty of the signals design engineer to consult with the signals inspection engineer, examine the sources of complaint, screen the causes and take remedial action. Earlier, difficulties were experienced with dynamotors. Steps were taken to improve them so as to provide a service-worthy product. Teething troubles occurred in the mass production of some transmitting vacuum tubes and certain other set components. Probably the most serious complaint from the Canadian army overseas was the tardiness in delivery of those stores which required original development.

What then of the post-war period, when industry reverts to peace-time pursuits? Much will be heard of post-war reconstruction, of the application of war evolved developments in the post-war era, of frequency modulation, of television, of radio-radar aids to sea, rail and air navigation. The industry appears to stand at the opening of a promising future.

Nevertheless, it seems proper that a note of warning should now be sounded. The natural barrier of the English Channel gave us protection for many months while we prepared to engage our enemies of this war. It now seems that the ocean may not be sufficiently broad to give us this respite against the weapons of the future. What then of the military approach to the post-war era? Canada was precipitated into a war for which there was little Empire preparation. At that time the democratic powers refused to treat the threat



Non tropicalized headgear showing condition before and after exposure to tropic conditions.

of war seriously and this prevented any definite progress towards Empire consolidation of design.

Are we to profit by the lessons of this war? Are we preparing to utilize and improve upon what we have learned so that in the event of future aggression we can at once commence industrial mass production?

It is now clear that the lack of early planning in research and development has been the seat of much productional difficulty. We must recognize that failure to have approved designs ready at the start of the war seriously interfered with output until well into 1943. Further, closer co-ordination of the communications design requirements of the three services is needed to avoid the paralyzing effects of three divergent service demands of ever-increasing complexity. This state of affairs must obviously be corrected if we are to obtain speedier output from industry in the event of another war. This is also the time to consider the planning of post-war facilities if the future of service research and development is to be assured.

If Canada is to assume her rightful place as a senior member of the Commonwealth, then Canada must contribute her share towards a continually integrated programme of co-ordinated service design post-war. The status attained as a result of progress made during this war will then have continuity, and will proceed without interruption.

In the words of the Financial Post of 26th August, 1944,

"We entered this war far behind our enemies in the application of scientific research to war. We kept on losing this war until we did apply research. The real story of our history is the story of research, of applied science."

APPENDIX

The care which is required in the preparation of the specifications to cover the manufacture of army signals stores and their components is outlined semi-technically below. It would be a serious breach of faith with the fighting forces to divulge the more technical aspects of specialized stores which at the moment are being placed in their hands.

Materials and finishes are designed to be rugged, to withstand repeated rough handling, extremes of climate and in many cases salt water immersion.

Where possible, phenolic insulants are moulded. Sawn surfaces must be re-sealed with fungus-resistant bakelite varnish.

Linen and canvas based laminated plastics, as well as wood and cellulose filled phenolics are avoided wherever possible since they are difficult to render proof against moisture and fungus.

Insulants must not be selected from inflammable materials, nor treated with varnishes which are subject to explosive action in the presence of electric arc or heat.

Where possible ceramic and steatite insulants are selected since they are highly resistant to corrosion and they also have low loss factors.

Paper based capacitors are required to be hermetically sealed in mineral oil within metal casings. The use of broadcast quality wax impregnated capacitors is strictly avoided. Rated working voltages are required to be 20 per cent higher than the maximum voltage ever encountered in service use. Capacitors are tested for 15 seconds at twice their rated working voltage. Ceramic trimmer capacitors are invariably used.

Resistors of the fixed variety are only acceptable if impervious to the infiltration of moisture.

Variable resistors must be capable of withstanding life tests of 10,000 complete operations without failure. They must also be protected against dirt and grease collection, humidity and resultant corrosive contamination.

Relays and switches must be capable of withstanding life tests of 10,000 complete operations without electrical or mechanical failure or appreciable wear at the contacts.

Wireless telephone sets must be capable of operation between the temperature limits of 70 deg. C. and –20 deg. C. at the highest and lowest input voltages to which they may be subjected in service use. The tolerance of channel frequency drift of the sender and receiver over these limits of temperatures and input voltages must be such that the audible signal is not carried off the dial settings.

Wireless sets must withstand test humidities of 90 per cent at temperatures of 55 deg. C. through specified cycles of dew point and operate normally shortly thereafter.

Wireless sets must pass inspection after vibration tests and falls on concrete floors so arranged that conditions over-simulate the exigencies to be encountered in the field.

Normal practice is to select at random one per cent of the total quantity of stores at contract for test as to quality. These tests, as a rule, can only be properly assessed by carrying out runs to destruction.

Brief reference may be made to the precautions now being taken by way of "tropicalization" of signals stores — a word which indicates the special treatment accorded stores destined for use in the jungle. Where it is impossible to protect stores from moisture-laden air or rainfall and where absorption and adsorption under day and night variations in temperature are present, microscopic plant life with strong affinity for moisture is conveyed by air and deposits readily on materials in the form of mould. Under these conditions, cotton, linen, wax, rubber, glass and metal surfaces support fungus growth. Temporary corrective action is being obtained by the application of moisture resistant coatings and by the use of materials less susceptible to mould growth. Research in quest of the final answer proceeds continuously in Great Britain, U.S.A., Canada, Australia and India.

To ensure that signals stores reach the fighting forces in first-class condition, whether the destination be Holland, Russia or the Far East, the utmost care is required in packaging. Portable wireless sets, for example, are first enclosed in cardboard or fibreboard containers which have been waterproofed, each container being complete with a dehydrating agent capable of maintaining the relative humidity of the enclosed air at 20 per cent or less. Each container is then completely suspended in 2" of dry shredded wood within a reinforced termite-proofed wooden box which is lined with a double layer of waterproofed paper; the layers being laminated together with asphalt membrane reinforced with crossed networks of non-elastic fibre. In respect to methods of packaging, reports from "beach landing" operations have been most gratifying—despite reports of ocean cargoes having been "watered down" by deck hose against fire.

OIL FOR DEFENCE AND ATTACK

(Continued from page 515)

these pipelines were extended through France across the Rhine until 120,000,000 gallons of petrol had been pumped through them into Germany. By this time, new flame-throwing tanks had carried the British wall of fire across the Rhine, under a smokescreen laid by the men who had protected British cities, and covered by British aircraft from the first airfields on the European Continent to be equipped with fog dispersal units. The attack ended in overwhelming victory.

The genius of the British inventors and engineers who fought and won these battles with oil, is already being applied to the problems of peace. New pipelines are still being laid to link Britain with the European Continent, so that it is forecast she will become the great oil distribution centre for all Europe. Civil airfields are being equipped with new and improved versions of the fog dispersal unit, so that the world airlines radiating from Britain will be even safer than they have been. In this way the achievements of British scientists and engineers during the war will not be forgotten.

OIL FOR DEFENCE AND ATTACK

Britain's Scientists Prepared To Set The Sea On Fire and Piped Petrol Under the Channel

Fog Turned On—And Off

S. GORDON COLLER

Courtesy of United Kingdom Information Service, Ottawa

Good news for the free peoples of the world comes with the publication of details of Britain's latest secret weapon—an impenetrable smokescreen apparatus for guarding airfields, factories and other key war objectives against attack. Japan, like Germany, staked much upon the technical lead which she believed to have gained by years of secret preparation for war. Her ablest students were sent to British and American universities to acquire the scientific capital of the West, while German technicians were imported as advisers in Japan itself. Now, when it is too late, Japan is learning that the centuries-old tradition of technical leadership cannot be imported and that the German advice upon which her war industry and its products were largely fashioned has proved inadequate.

Massive simplicity of conception is the hallmark of history's great creative inventions, and so it has been in the greatest scientific and technical triumphs of World War II. Only recently, for instance, have we known what a hot reception would have awaited the German army in Britain in 1940, had invasion been attempted in face of the British Fleet and Air Force. Germany had collected some 3,000 invasion barges in the Channel ports—her inventors had not provided the special landing-craft which months before, had been tested in the Thames—and at least 200 divisions were available to man them. In Britain were the remnants of the heroic expeditionary force withdrawn from Dunkirk—without arms; hundreds of thousands of civilian volunteers—without arms; and, fully equipped, a single armoured division, shortly to be despatched to Egypt by the bold decision of Mr. Churchill. With empty hands, Britain turned to her inventors, and they gave her the oldest of all weapons—fire: but fire harnessed with such industrial efficiency that not all Germany's tanks dared to brave the wall of flame that lay across the water.

Transparent Sheet of Flame

Oil pipes were laid down the beaches into the water, from which petroleum bubbled into heavy pools on the sea. Mixed with a special chemical which catches fire on contact with sea-water, it blazed into a transparent sheet of flame. On the coast behind, pipes were laid down each side of the cliff defiles which pointed to the interior, and pierced to spray oil over the whole area. Ignited, they became raging furnaces. On the roads behind these gaps, thousands of 60-gallon oil drums lay, concealed, on their sides, ready to gush a stream of blazing fuel 150 feet towards oncoming tanks. At airfields subject to parachute assault, armoured cars capable of shooting a tongue of flame vertically into the air, or along the ground lay ready for defence. The Germans heard rumours of these inventions. They designed asbestos suits for their soldiers, and sent them into the sea covered with burning petrol. The suits were defective, and hundreds died. The attack never came.

Germany turned to air attack, in face of the invisible screen of radar and the tiny, but deadly, R.A.F. fighter squadrons. Vital targets now became the factories which built the aircraft, and the airfields from which they rose, and the ports at which their petroleum was unloaded. And today we know that this same petroleum had provided also against air attack, thanks to British inventors. To every fruit-farm in Britain on the day after war was declared went out an urgent call for orchard-heaters. They were placed in up-wind circles, filled with crude oil and lit, until they spread a dense cloud of black smoke across the German target.

Then a British Admiralty engineer, Rear-Admiral Dight, designed a special version of the peace-time orchard-heater which could be towed by an army lorry, and carried fuel tanks, feeds and pumps. Dotted in hundreds through British towns, they proved that German raiders ignored vital targets thus protected and dumped their bombs among the civilians, whilst pressing home attacks on dummy targets camouflaged with smoke-screens. This led to the construction of chemical generators lit by electric circuits at the touch of a button, produced by thousands of British women hastily trained in war factories; 30,000 generators were needed to protect one town for one-and-a-half hours. The attack failed.

Fog Cleared in Ten Minutes

British bombers rose to attack German factories with new devices which enabled them to "see" through the darkness. In winter, when they returned, they often found their landing-grounds blanketed with yellow fog, so that the accident rate rose alarmingly. Mr. Churchill gave special instructions, and the British inventors who had created artificial fog for one victory, turned to destroy natural fog for another. Their objective was to clear a space 1,000 yards long by 150 feet wide to a height of 100 feet. Along each side of the main runway, a continuous line of petrol burners was laid, fed by a pumping and distribution system from huge storage tanks. Four Halifax bombers returning from the Ruhr found visibility only 100 yards. The vapour from the petrol burners was lit, its immense heat cleared the fog, and in 10 minutes visibility was equivalent to between two and four miles. The attack continued.

When Germany had been reduced by bombing, the Allied armies were ready to cross the English Channel into Germany from Britain. To move forward from the French coast, their thousands of tanks and vehicles required unprecedented quantities of petrol. And to supply that petrol, British inventors and engineers performed what—with the possible exception of the prefabricated "Mulberry" harbour—was their greatest feat of the war. Having built a 1,000-mile oil pipe grid from the British Atlantic ports of Liverpool and Bristol, linking all Britain to the south coast, they invented, made and laid 20 oil pipelines along the bed of the ocean to France. From August 12, 1944, onwards,

(Continued on page 514, to the left)

AN OUTLINE OF THE PRELIMINARY STEPS IN COMMUNITY PLANNING

Issued by the National Housing Administration, Community Planning Division

General Remarks

The National Housing Act, 1944, makes community planning a condition for long term housing loans and slum clearance grants for housing projects. Community planning is a local responsibility. Proper planning gives housing and home ownership stability. A plan for the economic use of land throughout the total area of a municipality will provide the kind of lot sizes which will make each house built, part of a comprehensive scheme for the whole municipality instead of a separate and isolated project. Because municipalities are creatures of provincial government, the success of the National Housing Programme depends upon unified action among all spheres of government.

There are three preliminary steps in community planning. When these have been taken, the next thing is to consult a qualified planner, who understands the relationship which exists among the component parts of a community and who possesses the experience and knowledge necessary to condition each part so that when all the parts are brought together, they will function economically.

I.—Preliminary Legislation

Adoption of legislation enabling municipalities to organize planning is a first step toward qualifying for long-term housing loans and the slum clearance grants made available by the National Housing Act 1944. As some of this financing may spread over a period of fifty years, local planning organizations should be established for that length of time.

Drafting of legislation, aimed at stabilization for home-ownership, improved living conditions and protection for the investment of private and public funds, is a matter which deserves careful attention. Before preparing such legislation it is essential to know the reasons why many of the present municipal difficulties exist.

Briefly stated, present problems owe their existence to subdivision of land for speculative purposes and to a habit of treating symptoms, not causes. Also to the practice of carrying out community development by specialized departments and without knowledge of what overall development should obtain. In consequence of this sort of planning, measures intended to relieve congestion often only serve to increase it. Failure to give proper consideration to all the physical and legislative factors, which condition the structure of a community has resulted in an increasing burden of municipal taxation.

The objectives, of continuous comprehensive studies and means of finding out what the ultimate and overall goals for community development should be, may be realized through legislative measures which make an overall Department, Bureau or Office of Planning, part of the establishment of Municipal Government. Such a Department, Bureau or Office should be administered by an outside, non-political board.

Membership of a Board to administer a Department, Bureau or Office of Planning would vary, in number, in municipalities of different sizes. Membership of Boards should be comprised of persons who enjoy public confidence and who understand the significance of the planning process. One member of a local council might be included to act as a liaison. Removal of a member from a board should only be by order of a judge. To safeguard democratic principles, legislation should provide that decisions of a Board shall be subject to veto by a substantial majority vote of the total membership of a council.

Legislative provisions should also clearly define the meaning of the term " Official Plan " as well as state how an official plan shall be legally adopted and modified. Besides outlining the powers and duties of a planning board, legislation should prescribe procedures for inducing public understanding of planning principles; also specify measures to encourage public participation so that the community as a whole may formulate the overall policies to the development of which local planning efforts are to be directed.

II.—Collection of Data

This outline was prepared by the Community Planning Division of the National Housing Administration, in response to requests made by officials of many of the provincial governments and by a host of municipal administrators. It is realized that the scope of the contents of this section are too limited in cases of very large cities and perhaps too broad for very small communities but it is hoped it will fill the needs of the average-sized community and serve as a useful guide to other municipalities.

By using a series of coloured maps—charts—graphs and written texts, where necessary, facts about the extent and location of existing municipal land uses may be briefly and simply defined and recorded.

With good leadership, a local Board of Trade—Social Agencies—Service Clubs—Teacher Groups—Interested Citizens and the Senior Classes of School Children, may be relied upon to gather much of the data listed below.

Maps

Map No. 1—Should record the following information:

(a) Total amount of land under municipal jurisdiction (Outline municipal boundaries in *black*).

(b) Total amount of land in municipal area covered by water (i.e. by rivers and/or lakes. Colour this portion in *blue*).

(c) Total amount of land in municipal area zoned for urban uses (Colour this portion in *yellow*).

(d) Total amount of land in municipal area zoned for rural uses (Colour this portion in *green*).

Paste in the lower right hand corner of map No. 1 a typewritten list showing the total acreage set aside for each of the above purposes and state the percentage each of these acreages is of the total municipal area.

Map No. 2—Should show how the total amount of land apportioned to urban purposes is divided among each of the following uses:

1. *Street Ways*—How many acres?
2. *Residential*

(a) Single family residence (Colour this portion or portions on map in *yellow*).
(b) Duplex or triplex uses (Colour this portion or portions on map in *yellow orange*).
(c) Apartment house use (Colour this portion or portions on map in *orange*).

3. *Industrial*—(Colour this portion or portions on map in *red*).
4. *Business*—(Colour this portion or portions on map in *purple*).
5. *Wholesale Area*—(Colour this portion or portions on map in *grey*).
6. *Public and Semi-public Buildings*—(Colour this portion or portions on map in *light green*).
7. *Off Street Parking Facilities*—(Colour this portion or portions on map in *tan*).
8. *Schools and School Grounds*—(Colour this portion or portions on map in *green dotted*).
9. *Parks and Public Recreational Grounds*—(Colour these portions on map in *dark green*).
10. *Private Golf Courses*—(Colour this portion or portions on map in *olive green*).
11. *Cemeteries and Other Open Development*—(Colour these portions on map in *dark blue*).
12. *Railway Facilities*—(Colour these portions on map in *black*).

When Map No. 2 has been completed paste a typewritten summary in the lower right hand corner showing the percentage each of the classifications indicated on this map is of the total area apportioned to urban purposes.

Map No. 3—Should outline the portions of the total municipal area which may be classified as depressed or blighted districts:

(a) Outline the depressed or blighted residential areas in *yellow* and state the approximate number of uneconomic or slum buildings in this area.
(b) Outline the depressed or blighted commercial areas in *green* and state the approximate number of uneconomic or slum buildings in this area.
(c) Outline the depressed or blighted industrial areas in *red* and state the approximate number of uneconomic or slum buildings in this area.
(d) Outline the depressed or blighted fringe or semi-rural slum areas in *blue* and state the approximate number of uneconomic or slum buildings in this area.

Paste typewritten statement in the lower right hand corner of this map stating whether or not policies or plans have been formulated and made for re-conditioning any or all of the above depressed or blighted areas. If so, attach copies of such plans to this map. Also plans for the development of new areas.

Map No. 4—Should outline in *green* the portion or portions of the total municipal area which have been apportioned to rural uses and should show the following details:

(a) Portions designated for 1-5 acre holdings (Colour such portion or portions in *yellow*).
(b) Portions designated for 5-25 acre holdings (Colour such portion or portions in *green*).
(c) Portions designated for 25-50 acre holdings (Colour such portion or portions in *grey*).
(d) Portions designated for 50-100 acre holdings (Colour such portion or portions in *brown*).

Paste statement in the lower right hand corner of this map indicating whether or not legislative authority exists for purpose of differentiating between rural and urban taxation in your municipality. If so, briefly summarize details.

Map No. 5—Should show the incidence of land assessment throughout the total municipal area.

This may be done by dividing the total range of land assessments into four equal groupings and by colouring, the lots and areas on the map which fall into each assessment grouping. The upper assessment grouping should be coloured in *black*; the second grouping in *blue*; the third grouping in *green*; and the fourth or lower grouping in *yellow*.

Note: Of all the factors which condition the physical structure of a community, it is the writer's opinion that the present method of land assessment, now in fairly general use throughout Canada, is the greatest deterrent to functional land use planning. Changes of this sort cannot be brought about in a day, however, the public knowledge, which will be gained from the studies noted herein ought to go a long way to create the general understanding which will be needed before changes to the present system may be made.

Map No. 6—Should define the municipal area serviced by a public water system. This area may be shown on the map by means of vertical hatching coloured in *red*.

Map No. 7—Should define the municipal area serviced by a public sewerage system. This area may be shown on the map by means of horizontal hatching coloured in *blue*.

Map No. 8—Should define the municipal area served by public transportation facilities. This area may be shown on the map by means of diagonal hatching coloured in *yellow*.

Map No. 9—Should show by means of a circle of 3/8″ diameter coloured in *red*—the location and size of every urban and rural plot served by septic tanks and by means of the same sized circle, coloured in *brown*—the location and size of every urban and rural property served with outside closets, also by means of the same sized circle coloured in *green* the location of every well now in use.

Map No. 10—This map should show the relationship between the community road system and the provincial framework of highways.

Map No. 11—This map should show the location of lots and properties municipally owned. Colour these portions in *red*.

Map No. 12—This map should show the extent and location of municipal development to date in accordance with the urban land use classifications noted on Map No. 1.

Map No. 13—Should show the densities and distribution of the day and night time populations by means of dots, each dot to represent a stated number of persons.

Map No. 14—Should show the topography of the municipal area and its surroundings.

Charts or Graphs

Chart or Graph No. 1—Show by means of a chart or graph the yearly increase in population from the date of incorporation up to and including the year 1944.

Chart or Graph No. 2—Show by means of a chart or graph the total yearly municipal expenditures from the date of incorporation up to and including the year 1944.

Chart or Graph No. 3—Show graphically, location and amount of peak traffic flows in downtown sections and the capacity of the street system to carry traffic loads of various sorts.

Text or Maps

School Facilities

Text No. 1—Should list the school facilities indicating capacities of same according to modern educational methods.

Existing Regulations Governing Height, Bulk and Spacing of Buildings.

Text No. 2—Should synopsize existing regulations covering the height, bulk and spacing of buildings in each of the urban land use classifications.

III.—Industrial and Commercial Structures

If the development of the community is to be directed toward a policy of optimum and continuous employment in the peace era, diversification of local enterprise is essential. Because of this fact, the second step in community planning is that of collecting and assembling factual information about the existing industrial and commercial structures. This may be done as follows:

Text No. 1—Compile a list of existing industries and estimate employment potentialities, if peace time machinery in each factory were used to capacity.

Text No. 2—Compile a list of existing commercial and other enterprises and obtain facts about the optimum employment potentialities of each.

Text No. 3—Should define the extent of the local rural base and state the amount of rural lands necessary to supply the urban population with food.

Final Remarks

If further information is desired in connection with the collection of " The Facts About Your Community " as a preliminary to making an " Official Plan ", it is suggested that you communicate with your provincial planning organization or with the Community Planning Division of the National Housing Administration, 102 Bank Street, Ottawa.

THE MANUFACTURE OF PROPELLERS FOR 18" TORPEDOES

(*Continued from page 509*)

but were still only rough ground on the front faces. The finish grinding of the front faces was done on a replica of the above machine (except that the master block had, of course, been machined from a front face). The time for finishing the front face with girl operators was 54 minutes.

With these machines, it was found possible to secure uniform thicknesses of the blade besides the requisite shape, so that no hand fitting or removal of metal for balancing purposes was required.

The final grinding operations were concerned with finishing the hubs and the radii at the roots of the front and back surfaces of the blades. Here again, the grinding action was mechanically controlled in such a way that the machine followed the correct radii and the operator could not gouge into the surface, thus spoiling an expensive product at the finishing stage. Figure 14 shows a close-up of the arrangement which involved the use of a ¾ by 48 in. abrasive belt driven at 5,000 surface feet per second and travelling over a rubber surface roller, 1.8 in. in diameter. In operation, the propeller has revolved on its own axis and thus moved across the grinding wheel. The belts were found to last an average of one and a half propellers, the time taken being 45 minutes for the hub and radius at root of back face, whilst the remaining radius at the base of the front face was ground with a similar machine in 20 minutes.

Thus were completed the machining operations, after which the propellers were polished all over by means of a felt wheel on an ordinary buffing lathe. The propellers were then ready for application of a number of gauges by the firm's and government inspectors. When finally accepted, the propellers were stamped with the serial number, pitch information, etc., and even this apparently simple procedure was " mechanized " in an attempt to make the process almost " foolproof ".

Conclusion

Needless to say, the above description does little more than illustrate the highlights of an exceedingly well integrated production layout, but it may nevertheless serve as an example of the way in which ingenious methods have been evolved in Canada to produce complicated war material with the bare minimum of skilled labour.

The author's thanks are due to officers of the British Admiralty Technical Mission and to Messrs. I. F. McRae, M.E.I.C., and W. Barnacal of Genelco Ltd., for their invaluable assistance in the preparation of this article.

From Month to Month

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

"A VOICE FOR ALL ENGINEERS"

Under this title the *Engineering News-Record* (McGraw-Hill Publishing Co., Inc.) of March 8th, 1945, ran an editorial, which should be interesting to Institute members because of its appropriateness to Canadian conditions and because of the approval and support it gives to a recent decision of the Institute's Committee on Professional Interests, relative to the formation of a collective organization of engineers and scientists.

The applicable portion of this editorial is reproduced herewith at the request of the Committee on Professional Interests. At the same time attention is called to the committee's report on page 391 of the June *Journal* which deals with the same problem in Canada. It is interesting to see this expression of opinion in a publication that is able to be free of organizational bias, because it is not the voice of any one organization. It is encouraging to the committee to find that its study of the subject and its decisions are so well supported by such an unprejudiced authority.

The "Joint Conference Committee", well spoken of in this editorial, is the form of cooperative organization which the Institute's committee has recommended, rather than the "overall organization" already approved by a group of societies in Canada but not recommended in the editorial.

The American Engineering Council referred to was established in 1920 and dissolved in 1940. It was a group "of engineering organizations serving as a central agency to further the public welfare . . . consider and act upon matters of common concern to the engineering profession — a means for giving national expression to the aims of the engineering profession as a whole, dealing with the relations of engineers to the public, and to the governments in matters of engineering content". It included eight national societies, thirteen state associations and twenty-five local organizations. It was well financed, well staffed and well administered, but it failed to do what was hoped of it. On the contrary, the evidence indicates it resulted in discord and disunity and "the voice for all engineers" if heard at all was not an harmonious one.

The editorial serves the useful purpose of facing the situation frankly, and of drawing attention to "the basic reasons" for the failure of such efforts in the past. There should be something to be learned from it.

Herewith the editorial—

"Persuasive arguments in favour of an organization to replace the American Engineering Council were made by Harold E. Wessman in his presidential address to the Institute of Consulting Engineers, which is reproduced elsewhere in this issue. Prof. Wessman would have the great engineering societies of America 'again band themselves together in an overall organization through which they may exert one powerful voice on those matters of national interest in which all engineers have a common stake'.

"The basic reason for the failure of the American Engineering Council is the same one which has resulted in the creation of the large number of engineering societies that we have today. Engineers have few interests in common; their interests are as diverse as their occupations, and their thinking of the industry or agency of which they form a part. Not only that; at times their views are diametrically opposed, as on the matter of public power development.

"Opinions within the administrative board of the American Engineering Council on many national questions were so divergent that the council actually kept a large segment of the profession from being heard on matters of direct concern to it. For example, in the dark days of the early Thirties the council by its inaction effectively nullified attempts of the American Society of Civil Engineers to support the federal government in its plan to stimulate expansion of local public works. Had that society been acting on its own in those days rather than through the American Engineering Council it would have taken a strong stand in support of a large programme of public works as an aid to economic recovery.

"It was instances such as this in which the A.S.C.E. board found itself in disagreement with the A.E.C. board that finally resulted in the civil engineers withdrawing from the council. The electrical engineers followed almost immediately. Today the A.S.C.E. has a much more effective voice in Washington than it had when it was required to speak through the American Engineering Council.

"While the American Engineering Council was still in existence the secretaries of the constituent organizations began holding meetings in conjunction with the annual assembly of the council to keep each other informed of developments in the several societies. After the abandonment of A.E.C. the secretaries of the four Founder Societies continued that practice, forming what came to be known as the Joint Conference Committee. Subsequently the presidents and most recent past-presidents of the societies were included and still more recently the American Institute of Chemical Engineers was added.

"In the Joint Conference Committee engineers have the nucleus of a more satisfactory agency for joint action than can be provided by an independent body like the American Engineering Council. The name should be changed to make it more indicative of the purpose of the organization; and the organization might be expanded somewhat but it should not be enlarged to the point of being cumbersome."

ENGINEERS "A DIME A DOZEN"

Perhaps the wages offered engineers through the Civil Service Commission at Ottawa are somewhat higher than this figure, but they are so low that the well-worn phrase readily comes to mind.

Examples are constantly before us. In publications and on notice boards there are usually lists of openings with the low wages unblushingly printed in bold type. Sometimes there are openings other than for engineers, and frequently at wages that are higher although for a lower grade of worker. The most recent example is a list issued by the Civil Service

Commission for the Department of Transport, No. 998. The list or poster speaks for itself. Look for a moment at this—

Aeronautical Engineer —Grade I — Male — $3,120.00.
Duties—Under direction of the Chief Aeronautical Engineer to have responsible charge of a staff of Senior Assistant Engineers engaged in checking and examining drawings, calculations and tests; to determine eligibility of aircraft, for a Canadian certificate of airworthiness under the terms of the Aeronautics Act of 1919 and subsequent amendments.
Qualifications—Graduation in applied science from a university of recognized standing; at least five years of experience in the design and construction of aircraft, three years of which shall have been in a position of professional responsibility, good knowledge of current civil airworthiness requirements applicable in Canada, thorough knowledge of aircraft and aero engine materials, their manufacture, processing and assembly and of the methods of testing such materials; ability to apply accepted mathematical methods to the design and strength of parts and to the design of aircraft.

Imagine this paragon of perfection being offered $260.00 per month, $3,120 per year — less income tax, and less 5 per cent for retirement fund. Surely the Commission isn't serious. Surely they know they cannot secure such a person for such a pittance.

The list shows others as well. A Senior Assistant Engineer is wanted for the munificent sum of $2,820 a year. He too must be a graduate with not less than three years' experience in a very wide and complex field.

The Value of an Education

Perhaps the most interesting angle is that right next to the Aeronautical Engineer Grade I the list advertises for a Supervising Inspector of Aircraft who is under the direction of the Aeronautical Engineer, but does not need to be a graduate of anything beyond a high school. His salary is $3,000 or $10.00 a month less than his chief, who must be a graduate. Five years advanced study, five years consequent loss of income, five years of expenses, earns $10.00 per month income ! ! What an inspiration to young men who contemplate becoming engineers ! What an outlook for men who are engineers ! What a policy ! In some way or other this seems to be related to the fable about killing the goose that laid the golden eggs.

Experience through the employment service of the Institute shows that no engineer with the necessary qualifications would even apply for a position such as that advertised at such remuneration. Private companies are offering more than double that—without getting the men they want. Surely government business is as important as private business. Why try to conduct it with engineers (or substitutes) who are worth only $3,120 a year, or $10.00 a month more than an artisan ?

DO NOT REMIT IN CASH ! !

Recently the loss in transit of money sent to the Institute in payment of fees, emphasizes the need of making such remittances only by cheque or money order. Several members still send cash through the mails. Some letters have gone astray.

Such methods never have been good business. It is appreciated that this is the easiest way to pay an account, but if the money never arrives the account has to be paid again, which is not so easy.

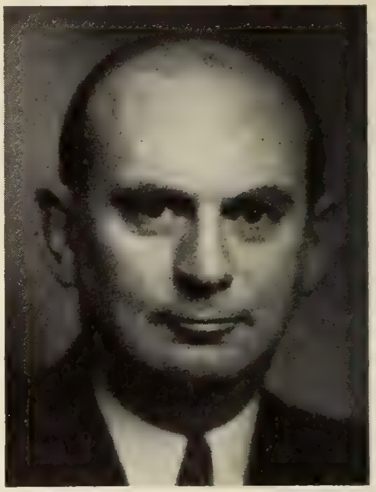
The Institute cannot be responsible for remittances in cash, unless they come by registered mail. This warning has seemed necessary because of the increasing numbers who do not take the customary precautions to protect their money.

A NEW BRANCH IN ONTARIO

At the June meeting of Council, a formal application was received from members in the Sarnia area, for the establishment of a branch there. With the application was a report which showed that over fifty non-members had signified in writing their willingness to join the branch if and when established.

With the situation so well surveyed and with such tangible evidence of their desire for a branch, Council granted the privilege without hesitation. Since then officers have been elected, new members acquired and preparation made for an opening ceremony in the Fall, including the presentation of the charter.

The best wishes of members everywhere will go to the new branch. The officers of the Border Cities Branch, of which Sarnia was formerly a part, have been particularly helpful, and their whole-hearted continuing support has been promised, until the newest member of the Institute family gets well established.



G. L. Macpherson, M.E.I.C.

The officers are—G. L. Macpherson, chairman; F. Frank Dyer, secretary-treasurer; C. P. Warkentin, E. W. Dill, C. F. Davison and W. E. Taylor, executive committee.

ENGINEER TO APPEAL COURT DECISION

The last mention in the *Journal* of the case of the Quebec Association of Architects versus Brian Perry stated that there would be little to report for some time, although work on the appeal was underway. For obvious reasons, it would not be wise to give publicity to all the movements.

To-day it can be reported that a leading legal authority has been consulted for advice in the appeal and after due deliberation has stated: " I am therefore of the opinion that the action should have been dismissed and that the appeal now pending should be maintained ".

This agrees exactly with the always held contention of the engineers and the defence lawyers, but it is encouraging to hear such unqualified support from an independent legal authority of such acknowledged expertness in this field.

The appeal will now go forward with the minimum delay—that is as far as the defendant is concerned—and it is hoped that the unreasonable and unacceptable decision of last February will soon be reversed.

"MULBERRY"

The British Harbour That Went to France

Everyone will recall that shortly after the thrilling news of "D-Day", the story was told of how the world's largest man-made harbour was towed from England to the shores of Normandy, thereby making possible the successful invasion of Europe, and thereby also shortening the war by many months with a proportionate reduction in loss of life.

The whole story of what was called the European war's greatest secret will be revealed to Canadians shortly. The War Office model of this project is now in Canada and will be shown from coast to coast under the sponsorship of the Hudson's Bay Company in collaboration with The Engineering Institute of Canada.

This is one of the largest undertakings with which the Institute has been associated. This joint arrangement with the Hudson's Bay Company has come about by the almost simultaneous decision of each organization to seek the model for Canada. When the similarity of plan and interests was discovered, an immediate conference arranged that it be done jointly. The Institute is greatly indebted to the Hudson's Bay Company for the generosity that has been shown in completing details of cost, responsibility, and control, and for their most cordial attitude throughout all negotiations.

Besides being a great secret, Mulberry was a great engineering achievement — one of the greatest in the world's history. It was entirely a British product — conceived, designed and built by the British. To these engineers the allied peoples owe a great debt for the boldness of their plans, the ingeniousness of their designs, and the courage of their execution.

The exhibition which is coming to Canada is the original War Office operations model which for so many dangerous months was the closest held secret, with only a few who had access to "the back room" knowing what it was all about. The story from beginning to end is more fascinating than the best detective or spy story ever written. It has all the elements of true adventure.

Mulberry was the world's largest man-made harbour, being over three miles long and over 1,300 acres in area. Its capacity and the statistics for the amount of goods and men handled are staggering. It is almost impossible to envisage what it represents. Perhaps a visit to the model and a view of the photographs and films will do for Canadians what their imagination has not been able to do for them.

The model has been shown previously only in London and Paris, and comes here direct from the latter city, on loan from the War Office.

The model requires two box cars for shipment. It will be accompanied by Royal Engineer officers from the War Office — men who have lived with the project from its inception. It is expected that the formal opening will take place in the Chateau Laurier early in September, after which it will go to Montreal, Toronto, Winnipeg, Calgary, Edmonton and Vancouver, returning east to Windsor, Hamilton, Quebec, Saint John and Halifax. The tour will require practically an entire year.

In order to carry out its share of the work associated with this tour, Council has arranged for the setting up of a committee with C. E. Sisson and M. J. McHenry, both of Toronto, as chairman and vice-chairman respectively. Mr. Sisson is also chairman of the Institute's Papers and Meetings Committee, and Mr. McHenry is chairman of the Committee on International Relations. The Mulberry undertaking seems to qualify under both these committees, and therefore the appointment of these two gentlemen is most appropriate.

It is expected that members of the branches will have a special opportunity to study the model, with technical information being supplied by officers of the Royal Engineers. For those branches where the exhibit is not shown, the film will be supplied so that every branch will have an opportunity to know something of this unique achievement.

Because of the size of the exhibit, the amount of space required and the time necessary to show it, it has not been possible to present it at every branch. This is unfortunate, but there seems to be no way out of it. It takes a week to set up the show and a week to pack it again. It is not easy to find from five to ten thousand square feet of suitable floor space that can be used for this purpose for a minimum of three weeks. It is to be hoped that the members in the other fourteen branches will find it possible to get to a nearby city where it is being shown.

The officers of the branches in the twelve cities will be asked to undertake certain duties in association with the personnel accompanying the model, and with the Hudson's Bay Company. This information will come from the committee.

ONCE UPON A TIME

A recent house cleaning in a section of the basement at Headquarters brought forth a small supply of certificates such as were issued by the Canadian Society of Civil Engineers to confer on a person "the right to practise as a Civil Engineer within the Province of Quebec".

In 1898 the first professional engineers' act was passed in Quebec. In revised form it is still the engineers' act in this province. It provided that only those persons who were members of the Canadian Society of Civil Engineers were entitled to practise engineering. The certificate was issued under that authority.

In Manitoba the first engineers' act was passed in 1896. It too restricted practice to members of the Society.

Since those early days there have been many changes. The Institute recognized that the acts should be provincial and therefore undertook to assist the engineers, province by province, to provide the necessary protection. Today the situation is much more satisfactory, and in every province the professional engineers' legislation is well established and well administered.

It is interesting, however, to look back a few years in order to appreciate how things got started and how far they have progressed.

Members who have applied for employment with the United Nations Relief and Rehabilitation Administration will be interested in the recent exchange of correspondence between this organization and Institute headquarters.

In answer to his letter to the director of personnel, inquiring as to the outcome of the many applications filed by members of the Institute, the assistant general secretary has received the following communication.

1344 Connecticut Avenue,
Washington 25, D.C.
July 12th, 1945.

Mr. Louis Trudel,
Assistant General Secretary,
The Engineering Institute of Canada.

Dear Mr. Trudel:

Since Mr. Harris has departed for one of our missions overseas, he has asked me to reply to your letter of 27 June in which you request information relative to the present employment in UNRRA.

I am sorry that you have not been informed earlier than this that we are not at this time recruiting for our industrial rehabilitation programme. Last fall we were under the impression that we would have immediate need for a number of trained engineers. However, at the present time it appears that that phase of our operations will not begin for some time. We are, of course, retaining the applications of all persons who apply to us for such work and will review them when appropriate vacancies arise. I would suggest, however, that no further recruitment be undertaken at this time, and that your members be informed that any further action on their applications is being held in abeyance.

I wish to assure you of our sincere appreciation for your interest and co-operation and regret that at this time no encouragement can be given to your many applicants.

Sincerely yours,

(Signed) William F. Howell,
Acting Director of Personnel
United Nations Relief and Rehabilitation Administration.

UNRRA in China

Just before going to press, there were two more developments that will be of interest to engineers. A letter from the Acting Director of Personnel told of the shift of principal interest from Europe to China, and supplied a long list of openings for personnel in that field. It is reproduced herewith.

23 July, 1945.

Mr. Louis Trudel,
The Engineering Institute of Canada,
Montreal 2, Canada.

Dear Mr. Trudel:

We regret exceedingly that we have not replied to your letter requesting information concerning the opportunities for employment in UNRRA for persons experienced in the engineering field. The delay was partly due to the rush of recruitment of personnel for the displaced persons programme now being carried out in Germany and partly because of the uncertainty as to the kinds of personnel which will be requested by the member governments.

Within the last few days our personnel representative returned from Chungking with the specifications for positions which are likely to be open in connection with the China programme. I am enclosing copies of these specifications for your use as you see fit. The China programme will probably constitute our major recruitment for personnel in the engineering field. We shall appreciate anything that you will be able to do to suggest personnel with the particular qualifications indicated and shall rely upon your judgment as to whether or not a notice in the bulletin is the best way to recruit the specialists needed.

Very sincerely yours,

(Signed) William F. Howell,
Acting Director of Personnel,
United Nations Relief and Rehabilitation Administration.

On August 9th, Wallace Clark, a representative of the personnel department of UNRRA, called at the Institute. A meeting of the Canadian personnel committee was held at Headquarters the same day with Arthur Surveyer, M.E.I.C., the chairman of the committee, presiding. Mr. Clark described in some detail the situation in China, emphasizing the urgency of the situation and pointing out the difference in UNRRA's position there as compared to Europe. In China there is a stable government and therefore personnel will be acting as expert consultants to the government, instead of members of a group functioning under agencies of the Allied Nations.

Not all openings that have been listed are to be filled now. A few need attention immediately but the others will be ready over the next two to six months. Several specifications call exclusively for engineers—others are of an administrative nature which seem admirably suited to engineers. The late arrival of the list of openings and the specifications has made it impossible to publish them in full with this *Journal*, but if members who are interested want more details than are shown on page 550, the Director of Personnel of UNRRA at Washington may be consulted direct.

The fields in which engineers are going to be required first are transportation, communications, highways and bridges, water and sewage, and restorations of industries. There are a few overall administrative positions, particularly in rehabilitation or restoration of industry. The most urgent need is for highways and communications.

The Royal Canadian Engineers are to be consulted as it is believed that many men who are or who have been overseas have had unusual opportunities to get experience of the type that will be most useful in China.

Unfortunately, is has not been possible to be very specific about the term of service, although a minimum period has been suggested as one officer's opinion as a year and a half after the end of the Japanese war. One year's employment is guaranteed. It seems reasonable that permanent or long-term service might develop with the Chinese government for some few of the more important positions.

MARITIME PROFESSIONAL MEETING

With the cessation of hostilities have come signs of returning activity in the Institute branches. Both in the East and the West there has been talk of holding a summer professional meeting. Recently the Maritime Provinces have taken steps towards that end, and Headquarters has been advised that dates have been reserved tentatively at the Pines Hotel, Digby, N.S., for a meeting in late August or early September, 1946.

The resumption of these professional meetings will be welcomed by members everywhere. They have always been such pleasant affairs, so filled with opportunities for professional advancement, and increased social contacts, that their return to the Institute's programme of events will mean much to the members.

There is one condition which cannot be overlooked in planning such meetings. The Institute membership and attendance at meetings has increased so greatly that the resources of many of Canada's pleasant summer resorts where the meetings are usually held will no longer be adequate, but this will not retard the plans which are already underway in more than one area.

MONTHLY REPORT ON REHABILITATION

The past month has been one of considerable activity for the Committee on Rehabilitation. The number of questionnaires being returned has decreased to one or two a day, but the number of members returning to civilian life is increasing. Fifteen have been interviewed during July whose release from the services appeared to be imminent, and who were anxious to avail themselves of the assistance of the Committee. Word has already been received that some of these have accepted offers made to them as a result of these contacts.

In June and July preprints of the employment page of the *Journal* were mailed to all members in the armed forces who had indicated their desire to find new employment opportunities. This resulted in about eighty applications being received in answer to the forty-one vacancies advertised. About half of these were forwarded on to the companies listed. The remainder being addressed to the box number of positions already filled, were, for the most part, re-addressed to the advertisers of similar openings in order to establish the desired contact with a minimum delay.

A pamphlet entitled "The Engineers Return to Civil Life" has been prepared by the Committee, in conjunction with the Department of Veterans Affairs. This was designed to cover the facilities for continued education under the Post Discharge Re-establishment Order, and to offer the advice of competent members of the profession to young engineers contemplating a return to University. This has been distributed to about one hundred and fifty interested members and a wider circulation is being considered.

At the invitation of the Royal Commission of Veterans' Qualifications, a verbal report of all the activities of the Committee on Rehabilitation was presented to the Commission, together with a number of copies of all the written material that has been sent out. As a result of this, the Commission has made a recommendation concerning the rehabilitation plans of the Engineering Institute, which will be published as soon as possible. The Institute was asked if it would be willing to undertake the application of similar measures to all engineers in the Armed Forces, and as an affirmative answer was given, the field of activity may be considerably enlarged.

The Secretary of the Committee on Rehabilitation was invited to be present the next day at a hearing by the Royal Commission of a petition presented by the veteran-students attending McGill University. The delegation pleaded the impossibility of living in Montreal as a student within the sixty dollars a month for a single man, or eighty dollars a month for a married man provided under the Post-Discharge Reestablishment Order. The Engineering Institute was pleased to support this petition, with emphasis on the need for an increased allowance for married men, because investigation has shown that this is the case. The Commission appeared to receive the suggestions favourably, and a recommendation on this subject is being made.

The Universities are anticipating an extraordinarily large undergraduate enrolment this year, due to the number of ex-service men intending to take advantage of the financial assistance offered by the Government. It will therefore, be necessary to find additional instructors, and the suggestion has been offered by the Committee that a number of members of the Institute who want post-graduate and refresher courses might be interested in part-time teaching. This plan would enable graduate engineers from the forces to undertake courses that may otherwise have to be denied them, due to shortage of teaching staff, and would also provide part of the help needed to accommodate the increased undergraduate demand. The deans of engineering of several Universities have endorsed this scheme, and it is hoped that the circular letter sent out in July to some three hundred members in uniform will elicit a satisfactory response.

POSTGRADUATE SCHOLARSHIPS

Opportunity for postgraduate training in science for men and women whose studies have been delayed or interrupted by war service, either military or civilian is now being offered by the National Research Council of Canada.

Three classes of award are available for the academic year 1945-46 as follows:

BURSARIES of the value of $450 will be open to award to applicants who have graduated with high distinction in scientific study.

STUDENTSHIPS of the value of $750 will be open to award to applicants who have had experience in research work in science for at least one year following graduation.

FELLOWSHIPS of the value of $900 will be open to award to applicants who have given distinct evidence of capacity to conduct independent research in science.

Applications received before 15 August 1945 will be considered and awards announced before 1 October 1945. Additional applications received by 15 November 1945 will be considered and awards announced by 31 December 1945.

Detailed information with respect to these awards, and a copy of the required application form may be secured upon written application to the Secretary-Treasurer, National Research Council, Ottawa.

QUEBEC COOPERATIVE AGREEMENT

Although many applications have not been dealt with yet, and the period for the special privileges does not expire until the end of the year, there are encouraging proofs that the agreement between the Corporation of Professional Engineers of Quebec and the Institute will go a long way towards facilitating cooperation in the province. So far there have been 159 new members admitted to the Institute and 111 transfers from Student or Junior to Member—a total of 270. Over 200 members of the Institute have been admitted to the Corporation in the same period, and a further 100 applications are still to be dealt with.

Herewith are the names of new members which have not been published previously.

ADMISSIONS

Members

S. J. Aboud	O. Doob	W. T. May
E. B. Archibald	P. E. Dufresne	R. L. Meek
G. H. Archibald	N. Farrar	R. Meloche
H. A. Barends	R. J. Faucher	T. M. Melrose
A. Batey	E. C. Fortin	K. Mercer
A. K. Bayley	A. Fournier	J. Missler
P. F. Beaudry	W. Fraser	C. O. Monat
J. C. Beique	R. Frigon	J. P. Norrie
L. C. Beliveau	J. D. Fry	W. J. Orr
J. E. Bertrand	J. L. Gavan	S. Ouimet
L. P. Bonneau	D. M. Giachino	A. J. Papineau
H. Borduas	W. A. Gilmour	D. Paquet
M. G. Boudreau	E. Goulet	R. H. Patten
R. G. Bourke	O. Graham	H. E. Pawson
A. E. Bowden	D. A. Gray	C. Perras
M. Boyer	M. H. N. Gruner	J. E. Perron
J. P. Brillon	R. A. Guay	L. Pineau
A. Brosseau	F. J. Hoar	J. Presner
J. Brosseau	H. H. J. Hurtubise	M. A. Prudhomme
H. F. Bush	G. F. Inglis	W. L. Pugh
E. Busso	W. D. Jewett	O.R.L.A.Ouevillon
N. H. Cale	G. A. Johnson	F. J. Raskin
F. Calder	J. R. Joncas	H. E. Read
R. Cartier	B. Kelimbet	H. H. Remine
A. J. Chabot	J. L. Kielland	J. R. Rousselle
H. Chapleau	J. L. Killoran	W. H. Schippel
J. D. Chene	J. S. Korwin-Gosiewski	J. M. Scott
D. D. Clarke	T. Koulomzine	W. F. Simpson
J. M. Cohen	C. R. Laberge	R. W. Sterns
S. A. Craig	A. E. Lafleur	A. L. Stewart
T. C. Creaghan	E. Lamarre	D. Stewart
L. Crepeau	F. Leblanc	C. J. Tanner
V. F. Crowley	J. E. Leclerc	J. R. Taylor
E. Dagenais	M. L. L'Heureux	J. A. Trahan
F. W. Dakin	G. R. L'Hoir	V. I. Traversy
A. B. Darling	D. C. MacCallum	A. Trottier
G. D. Davidson	E. MacEwen	F. Valiquette
A. Decarie	K. A. MacKinnon	P. Venne
R. B. Delvin	P. E. McIlhargey	G. W. Warner
A. Deschamps	G. D. McTaggart	E. E. Wells
A. M. Deschenes	Y. Marchand	A. A. J. Westman
L. Desrochers	E. H. Manley	A. Winnikow
K. J. Dewhirst	R. Marien	J. D. Young
E.W. B. Donohue	C. Marsan	J. Zorzi

Transferred from Junior to Member

T. G. Anglin	P. Descoteaux	J. Lefort
J. V. Arpin	R. Desjardins	J. J. Lefebvre
C. A. Auclair	R. A. de Villers	H. J. Lemieux
G. O. Beaulieu	J. Drouin	L. Letendre
S. G. Becker	F. Dugal	J. S. Lochhead
H. F. Beique	R. C. Duquette	J. P. E. Marion
L. Belanger	J. Dussault	R. J. Merritt
M. Belanger	M. Fleury	J. Morency
J. G. G. Belle Isle	J. J. Fortin	R. P. Ouellette
R. Boisclair	G. Gauthier	P. Pelletier
C. Bourgeois	A. Gervais	G. Proulx
J. E. Brett	M. Gravel	J. Racicot
R. C. C. Brown	W. L. Hare	L. G. Roland
P. Cadrin	G. Hebert	M. Scheen
J. P. Callum	A. G. Hibbard	P. M. Smith
C. E. Campeau	T. W. Houghton	L. Swift
L. Cartier	J. Hurtubise	W. J. Tanner
A. Cholette	R. A. Kerr	J. Tetreault
J. E. Cousineau	M. L. Laquerre	H. H. Tinkler
A. D'Amours	J. Laurence	A. Trudel
L. Delisle		

Transferred from Student to Member

L. Allaire	D. Fraser	M. Nantel
H. Audet	R. Gauthier	M. Pepin
R. Baribeau	F. H. Iliffe	W. Plante
R. Baril	L. Joncas	L. A. Prudhomme
B. Beaupre	R. B. Killam	R. Quintal
R. Bennett	J. H. Langevin	J. Ricard
M. Benoit	J. L. Laroche	A. Rousseau
L. Caron	J. C. Laverdure	W. J. Routley
P. Carriere	A. Leclerc	J. J. Samson
F. Chadillon	G. A. Leonard	J. Sansfacon
C. Clairmont	J. J. Leroux	S. Sheinberg
E. Dauphinais	G. A. E. Lindsay	J. Shooner
P. deLamirande	C. R. Matthews	J. Trudeau
L. Dumont	J. Miron	M. Turgeon
J. J. Dury	H. K. Morris	H. G. Wein
A. D. Fish	F. Mousseau	

PROFESSIONAL INSTITUTE OF THE CIVIL SERVICE IN CANADA

Celebrates 25th Anniversary

It is interesting to read of the modest beginning in 1920 of this now strong and important organization, and interesting too to discover that the inspiration for its inception came largely from the desire to do something about under-classification from which the group was suffering, at that time—as it is now.

The story of twenty-five years development is told in interesting detail in a special booklet issued to mark the occasion, " Silver Jubilee History " of which J. Stuart McGiffin is author.

Throughout the narrative there is frequent mention of persons whose names are well known in Engineering Institute circles. The first illustration is a picture of J. B. Challies who is referred to as the " Guiding Spirit in founding the Professional Institute ", and to whom honorary membership was granted subsequently. Referring to the under-classification and the then domination of the civil service group by the clerical branch, the report states " The dissatisfaction engendered by this state of affairs found expression in a meeting of the Ottawa Branch of The Engineering Institute of Canada when John B. Challies, then superintendent of the Water Power Branch in the Department of the Interior, drew attention to the recent formation in Britain of a Professional Association of Civil Servants. It is recorded in the minute books of the Engineering Institute that on January 6, 1920, Mr. Challies suggested that consideration might be given to similar action in Ottawa." At a subsequent meeting of the Engineering Institute, on a motion of Dr. Challies and Mr. John Murphy, a basis was established for bringing together several organizations to work cooperatively on the proposal which in February 1920 resulted in the Professional Institute.

Among the 22 presidents of the Professional Institute there are many who were also active in the Engineering Institute, three of these becoming president, i.e., Challies, Mountain and Cameron. Other members who have helped make history for the Professional Institute are: F. V. Seibert, N. J. Ogilvie, A. E. MacRae, D. W. McLachlan, J. G. McPhail, J. L. Rannie, F. H. Peters, John McLeish, T. A. McElhanney, C. D. McAllister, and doubtless others.

Members of The Engineering Institute of Canada in all parts of Canada will be gratified to see the support that has been given to the Professional Institute by the engineers. The Institute's interest in the professional civil servant is very real and there seems to be no reason why the names of engineers will not be equally prominent when the chronicle of the next twenty-five years is being written.

Throughout the detailed account of the eventful 25 years it is noticeable that frequent approaches were made to the government by the Professional Institute on behalf of the professional workers, but there are too many accompanying entries that indicate the missions were not successful. The history shows clearly that the struggles for recognition of the professional worker has been a long one, and with discouraging results. Under the heading " The Battle for Reclassification and Salary Adjustments " this whole story is laid out in detail. It is impossible to understand how a case presented so intelligently and frequently could be ignored for so long.

For the future the Engineering Institute wishes the Professional Institute continued inspiration in its struggles to accomplish its objectives. Its cause is just. Surely the steady insistence that something be done will be heard and heeded eventually.

A MESSAGE FROM CHUNGKING

Herewith is a letter from a member in China, who is commercial counsellor to the Canadian Embassy at Chungking. It deals with the 13th annual conference of the Chinese Institute of Engineers. It may come as a surprise to many to know that over 1,600 engineers attended the conference, that there are over 9,000 members of the Institute, and that they are able to and feel justified in holding their annual meetings right through a most devastating war.

The invitation, programme, badge and windshield sticker which accompanied the letter are very picturesque and intriguing. The programme is being translated for the *Journal* so that a study may be made of its contents. It will be interesting to discover the subjects that these engineers find important during the invasion of their country.

Mr. Palmer's thoughtfulness in sending this excellent letter is much appreciated.

Chungking, China,
June 7, 1945.

L. Austin Wright, Esq.,
The Engineering Institute of Canada,
Montreal, P.Q.

13th Annual Conference,
Chinese Institute of Engineers.

Dear Sir,

It was my great pleasure to attend the opening ceremonies with which the 13th Annual Conference of the Chinese Institute of Engineers commenced yesterday, June 6, 1945.

Since I have been in Chungking I have been at pains to cultivate members of the engineering profession, for the very obvious reason that engineers must play a large part in shaping and implementing the many and varied plans now being laid to rehabilitate and reconstruct China. Recently I called on Dr. Shih Chih-Jen, a graduate of Massachusetts Institute of Technology, and discussed with him, in his capacity as Director of Railway Administration in the Ministry of Communications, China's post-war requirements of railway equipment and supplies.

Later I called on the vice- or deputy-Minister of the same department, Mr. Ling Hung-Hsiang, and offered my cooperation in the fulfilment of their plans. Having practised as a civil engineer, I find I frequently am able to be of service to such people as I have just mentioned. Mr. Ling and I went on to talk, somewhat professionally, on bridges. Mr. Ling suggested I call on Dr. Mao, general manager of the China Bridge Company.

When I called on Dr. Mao, his office building was full of people, and I discovered they were engineers registering for participation in the 13th conference. Already some 1,000 men had registered, and paying the fee of 500 dollars Chinese, or nearly 50 cents Canadian.

Soon I had a chance to talk to Dr. Mao, who knows of most of our bridge companies, and to my delight he invited me to attend the official opening.

There are in China some 9,000 professional engineers, who are members of the Institute, of which there are six branches. I went to the opening and found it was attended by 1,600 engineers. The proceedings opened with a formal remembrance ceremony, to the memory of the founder of the modern Chinese Republic, Dr. Sun Yat Sen. It was most impressive to see 1,600 men all smartly bowing from the waist towards a large picture of Dr. Sun, at the order of a Master of Ceremonies. I felt at home during the playing of the Chinese national anthem by a military band. Some wanted to sing and couldn't, while others who possibly could sing didn't.

The opening address was delivered by Dr. Wong Wen-Hao, a famous geologist, and presently Minister of Economic Affairs, and Chairman of the War Production Board. A little man, but chock-full of vitality. Unfortunately he has lost all three sons in the war, in the air force.

I am enclosing a badge of " guest ", a programme, and my invitation, which I thought might interest you.

I talked to many of those attending and they all expressed deep pleasure that a member of The Engineering Institute of Canada had found it possible to attend. I thought the foregoing might be of interest.

Yours sincerely,

(Signed) Frederick Palmer, M.E.I.C.
Commercial Counsellor, Canadian Embassy.

WARTIME BUREAU OF TECHNICAL PERSONNEL

Monthly Bulletin

University Science Students

During the month of May permits were issued for the employment of a further 273 male science graduates from the class of 1945. The distribution of these permits as between different types of activities was very similar to that reported for the month of April.

One hundred and thirteen newly graduated science students entered training centres either with a view to qualifying for technical appointments in the Navy or the Army, and 147 third-year students (who still have one more academic session to complete) went into training for the summer with either the Navy or the Army. This latter group will be available for consideration should there be any further need for graduating students in the Spring of 1946.

Practically no difficulty was experienced by undergraduate students in securing suitable summer employment. Even fewer students than in previous years approached the Bureau for assistance in this regard. It would appear, therefore, that the efforts made to secure in advance from industry a comprehensive list of vacation employment openings for the use of such students has once again more than justified itself. There are evidences that an increasing number of employers are giving consideration to establishing a policy of offering vacation employment to undergraduates with a view both to assisting in the proper training of students and also creating an opportunity to select some of them for permanent employment on graduation.

Permanency of Employment

With the completion of the tabulation of data regarding technical persons on record, a start has been made on various analyses of the information thus made available.

The first study made in May involved an assessment of the employment position of each technical person registered as to permanency or otherwise. Certain broad rules were followed such as the classification in "temporary" category of all those known to be serving in the Armed Forces. Others so classified included persons who have changed employment since the outbreak of war and entered some field of war production, and those who graduated in wartime and whose employment therefore has been determined on the basis of labour priorities rather than unrestricted choice of civilian activities. It is realized that this method of classification may tend to exaggerate slightly the extent of the resettlement problem; but, on the other hand, it must be remembered that registration is not yet complete.

Out of a total of 33,909 technical persons whose records were assessed in this regard, it was found that 12,486 might be classed as in a temporary occupation.

Information on Service Personnel

The second task undertaken under the survey was to endeavour to obtain more complete information on some 1,500 technical persons about whom the only information on file was the fact that they were technical persons and were serving in the Armed Forces. With the co-operation of the Manpower Statistics Unit of the Department of Labour it was possible to secure sufficient data for survey purposes in the case of some 40 per cent of those for whom the Bureau had previously had little other information than their names and the fact that they were in the Armed Forces. In the case of the remainder of this group, numbering just under 900, other steps will be taken to secure the missing particulars. One important factor in this respect is the small but steady flow of persons who visit the Bureau in connection with their return to civil life. Among these are found a number not previously registered, due in most cases to absence overseas, but who are glad to provide the necessary information in order that the overall picture of the rehabilitation problem may be as complete as possible.

Geologists in the Services

A third study made during May was undertaken in connection with the problem facing the mining industry. This involved the determination of the number of geologists who might be expected to become available for civilian work in this field as a result of demobilization. It was found that there were complete records of 131 such persons from which it could be assumed that the total number eventually available will be in the neighbourhood of 175.

CENTRAL HEATING

As part of the Institute's activity in the field of community planning, it was decided by Council at its last meeting to establish a Committee on Central Heating. It is expected that shortly a detailed announcement will state the personnel of both the committee on heating and on community planning, but in the meantime it will be interesting to read the following announcement about the city of Chisholm, Minnesota, "the first American city to enact legislation that will provide city-wide central heating as a post-war project". This information was sent to the Institute by the Mayor, John Gornick, Jr.

Chisholm, St. Louis County, Minnesota, Approves Postwar Central Heating Plan

Determined to free their city from smoke and soot and to solve forever their domestic, commercial and industrial heating problems, the Chisholm City Council has just passed an ordnance granting a franchise for furnishing central steam heat and electric power to the entire city, from a cooperatively owned plant. The plan was considered doubly attractive because it provides an ideal civic improvement project for postwar construction and employment.

The franchise, awarded to John J. Dwyer of Duluth, authorizes the construction of an adequate steam and electric generating plant with the necessary underground heat distribution lines and electrical circuits, just as soon as war production schedules permit release of materials.

Steam service will be made available to every residential, commercial and industrial building, where it can be adapted to existing warm-air, hotwater or steam heating systems. It was brought out at Council meetings that this would completely eliminate the need for individual furnace stoking and ash handling, and would abate a smoke nuisance, assuring a cleaner, more healthful community. Preliminary estimates indicate that the overall fuel consumption will be reduced approximately 25 per cent. Another benefit considered was the utilization of extra basement space upon removal of individual furnaces. It was also pointed out that new homes could be spared the expense of basement excavation and construction.

The city is now served with light and power from an extensive power transmission system. Under the new plan, the citizens of Chisholm will purchase heat —along with electricity, gas and water, from a central source.

Central steam heating is in use today in downtown and industrial areas of most of our large cities. In some cases, lines have been extended to bring its benefits to residential areas. However, Chisholm is the first American city to enact legislation that will provide city-wide central heating as a postwar project.

CORRESPONDENCE

An Engineering " Clinic "

June 1, 1945
101 — 4th Ave.,
Ottawa, Canada

The Editor,
The Engineering Journal:

Dear Sir:

The success of medical clinics is well known. Such a clinic consists of specialists in the different branches of medical science, in partnership and collaboration, in obtaining the best possible diagnosis and treatment in difficult and complicated cases. As aforesaid, the success so obtained has in many cases been remarkable. Why not a clinic of consulting engineers? A large engineering project, such for instance as a water-power development requires expert knowledge of civil, electrical, hydraulic and mechanical engineering. No one man can completely deal with all these different branches of engineering science. A partnership formed along these lines and operating under some distinctive title like the word " clinic " should surely be in a position to attract a large proportion of important consulting engineering work, and be called upon to adjudicate in cases of technical dispute.

" Clinic " is so far essentially a medical term, but why should it not also become an engineering term? The recent Sheldon's Medical Dictionary defines clinic as " An institution in which medical attention is given to patients— ". The word " clinic " has been taken from the original meaning to be now used in the sense of an association or partnership between medical specialists, in different lines as in the case of the famous Mayo Clinic. Why should not the same word be adopted by the engineering profession to denote a similar partnership of experts in different branches of engineering science.

(Signed) H. E. M. Kensit, M.E.I.C.

On Standard Engineering Fees

Ottawa, April 20, 1945
922 Hunter Building

The Editor,
The Engineering Journal,

Dear Sir:

Mr. C. D. Norton in his letter appearing in the March issue of the *Journal* has dealt with a matter of vital importance to the profession, yet about which no one appears willing to do anything.

I recently wrote the Association of Professional Engineers of the Province of Ontario on this same subject and suggested the time was ripe for introducing some form of activity having for its object the elimination of this state of affairs.

It seems to me that concerted action by all interested parties is indicated. Only by such action can results be obtained.

In discussing the subject of free design with representatives of steel companies, both structural and reinforcing bar, they all profess to deplore present conditions but at the same time put forth many reasons why they must continue. It is in these companies' own interests to obtain a fee for the professional work they carry out and one would assume they would welcome an arrangement among themselves.

If however, they are unwilling to institute such an arrangement, I feel the engineering profession as a whole should get together and demand that steps be taken to compel any engineer to charge standard fees for any design work he carries out, whatever branch of engineering it concerns.

The proper parties to deal with this vexed question are, in my opinion, the Engineering Institute and the various provinical associations.

That is why we support these bodies—to look after our interests and not to confine their activities to the purely academic aspect of the profession. Here is a challenge to them to be of real service.

Since it is engineers themselves who are the offenders, it should not be a difficult matter for their own institutions and associations to bring them into line with any reasonable suggestions for the elimination of this " cutting of their own throats ".

I suggest the setting of a definite date for the cessation of all free design, with notices to this effect inserted in the technical press.

We cannot expect the general public to value our services when we, by our own actions, indicate that they have no value whatsoever except as sales propaganda.

I hope that all those who are vitally interested will indicate the fact by communicating with their societies on this subject.

A steady demand for action, eventually will compel action.

Yours faithfully,

(Signed) H. B. Dickens, M.E.I.C.
Supv. Structural Engineer.

It is just over three years since the first Washington letter appeared. As there have been several gaps when I was either away from Washington or out of the country, this is the thirty-second letter. It will be the last Washington letter as such. After three and a half years in the service of the Australian Government, I feel that my contribution to the country of my birth has been completed. While my work was originally largely technical in character, the last two years have been almost wholly administrative and I was getting farther and farther away from my own engineering profession. A recent opportunity to join the United States Steel Export Company appeared to combine both my Washington experience and my background with Dominion Bridge. It seemed too good an opportunity to miss. For some time, therefore, I will be situated in New York. Whether it will be possible to continue these letters in some other form remains to be seen.

In looking over these letters, they bring back to me so much more than it was possible to include. It is with much gratitude that I realize how rich the experience has been. All the difficulties, heartbreaks, conflicts, lost motion, long hours and midnight oil are rapidly being forgotten and only the sense of achievement, of a job accomplished, remains. As far as Australia was concerned, the margin between success and disaster was perilously thin. When Japan struck, Australia was practically undefended; she was still relying largely on an increasingly hard pressed England for supplies which had to come over a much lengthened and dangerous sea route; and most of her manpower was still in North Africa after taking a prominent, heroic and costly part in the campaigns in both Africa and Greece. However, the vast quantity of supplies, ranging from paper clips and ammunition to freighters and four engine bombers, did get there in sufficient quantities and in sufficient time. These supplies from North America had to do with Australia's contribution. In addition, great numbers of men and great quantities of supplies were rushed forward by the United States on their own behalf. The battles of Midway and the Coral Sea were probably the turning point in the war in that area.

I shall never forget the first half of 1942. Washington reflected the nation's shock at being plunged into war. In spite of all, Europe was regarded as the first job. Yet crises existed in every theatre. The gap between requirements and supply was alarming in the extreme. In supply circles we described our task as "dividing a deficiency". It is important to note that it was not a deficit after American requirements had been met. It was an overall deficiency-towards the overcoming of which all the resources of all countries were merged in the common pool—in the sharing of which the American Army, Navy and other authorities argued their cases and presented their claims before the Joint Munitions Assignment Board or other combined Boards on an equal footing with all other claimants. The machinery of the combined Boards was rapidly built up and the herculean task of planning and allocating the production of the United Nations on a worldwide basis was attacked with speed, courage and imagination. The Americans deserve great credit for the impartial manner in which their own supplies were parcelled out. In commenting on the magnanimity of official Washington in the early days, I must add that Canada played a great part in leading the way and in making her own contribution in this concept of mutual aid. To have been part of this process was a great and stirring experience. If business and government leaders can approach the problems of peace with anything like the same wisdom and magnanimity, we will have little to fear.

Recent Developments

For the record the following are a few of the highlights of the past month. As this is written, the Big Three are conferring at Potsdam. Japanese soil is under actual naval bombardment as well as ever increasing air attacks. Byrnes has succeeded Stettinius as Secretary of State while the latter becomes the American member on the Security Council. Bretton Woods proposals have been adopted by Congress with only minor changes. Dr. Vannevar Bush's recommendation to Congress for a generously endowed permanent National Research Foundation and Senator Magnuson's ennobling bill are being widely discussed. Most important of all, of course, is the only heartening unanimity in support in both House and Senate of the San Francisco Charter. The picture is in such marked contrast to the last time when the League was bitterly discussed for nearly eleven months and then defeated. It is with regret that I record the passing of the Hon. John Curtin, Prime Minister of Australia. His successor, the Hon. J. B. Chifley, is a very good and able man. I met Mr. Curtin on several occasions when he was in Washington last year, and I also came to know and respect Mr. Chifley whom I met in Canberra in 1943.

There is an interesting sidelight on Congress which may be a sign of the times. The present Congress is noted as being the most travel minded in history. Already, about two hundred members of the seventy-ninth Congress have returned from trips abroad. Two groups have travelled all around the world. Eleven members recently left on a six week fact-finding tour of the British Isles and Scandinavia. Another group is visiting the Middle East. Members of a State Department subcommittee are touring State Department facilities. Five members of the Foreign Affairs Committee are to fly shortly to Russia, Poland and the Balkans, and other trips are being planned by this influential committee. In mid-August a twelve man mission will undertake an economic survey of Europe. Other groups are planning to investigate such matters as newsprint and petroleum supplies, communications and relief. Several other groups are already in the Far East.

Newcomen Lunch

The recent luncheon in New York at the Pierre Hotel of the American Branch of the Newcomen Society of England may be of interest to Canadian engineers. The guest of honour and the speaker was Mr. D. C. Coleman, president of the Canadian Pacific Railway. He was introduced by Dr. C. W. Colby of Montreal. There were a number of prominent Canadians present including the Rt. Hon. Arthur Meighen, the Hon. Hugh Scully, Sir Frederick Carson, Blair Gordon, Dr. A. H. McGreer of Bishops, J. H. Gundy, William Black of Otis Fensom, Earle Spafford of Imperial Tobacco, W. M. Neal of C.P.R., D. McK. Ford of C.N.R., William Casey of Canadian Locomotive Works and several others. Before the lunch, I had cocktails with de Gaspé Beaubien and L. Austin Wright. The Institute was well represented.

July 25th, 1945. E. R. Jacobsen, 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 a basis of personal items in the *Journal*.

Major-General C. R. S. Stein, M.E.I.C., has been named a member of the United Nations Relief and Rehabilitation delegation for Warsaw. He has been with UNRRA since last February, working in Washington.

C. J. Mackenzie, M.E.I.C., president of the National Research Council, has been conferred an honorary doctor of laws degree by the University of Saskatchewan for his outstanding leadership in scientific research and for his contribution to higher education, especially in the University of Saskatchewan where he was dean of engineering for several years.

T. R. McLagan, M.E.I.C., general manager of Canadian Vickers Limited, Montreal, since 1940, has been elected to the board of directors of the company. He also occupies the position of industrial consultant with Dufresne, McLagan and Associates in Montreal.

Colonel H. G. Thompson, D.F.C., M.E.I.C., who was granted leave of absence at the outbreak of war from his position as manager of Aluminate Chemicals Limited, has been released from his most recent appointment as director of mechanical engineering at National Defence Headquarters, Ottawa, and has resumed his former duties with the company. **Colonel R. L. Franklin,** M.E.I.C., has been appointed director of mechanical engineering, succeeding Col. Thompson.

(Acting) Electrical Captain E. G. Cullwick, M.E.I.C., has been promoted from electrical commander to his present rank. Captain Cullwick, who was head of the department of electrical engineering at the University of Alberta, was granted leave of absence in 1942 to assume the position of director of electrical engineering, Naval Service Headquarters, Ottawa.

J. R. Donald, O.B.E., M.E.I.C., recently resigned as director-general of the chemicals and explosives branch of the Department of Munitions and Supply. Mr. Donald will leave shortly for the United Kingdom and Europe on a special departmental mission before returning to private business as a consulting chemical engineer with J. T. Donald and Co. Limited, Montreal, of which he is president.

Among the achievements of the chemicals and explosives branch, which has been headed by Mr. Donald since early in the war, were the introduction of a new process for the mass production of the super-explosive R.D.X., improved methods of T.N.T. production, the successful adaptation of ammonium nitrate surpluses as general fertilizer materials, and the large scale use of wood-pulp to replace cotton liners in the making of propellants.

From 1915 until 1918 Mr. Donald served as chief inspector of explosives for the Imperial Munitions Board. At the close of the first World War he worked for a few years with the Canadian Packing Company, Ltd., and in 1922 returned to J. T. Donald and Co., Ltd., from where he was called to Ottawa in 1939.

G. A. Vandervoort, M.E.I.C., chief engineer of the New Brunswick Electric Power Commission, has retired on pension. He became associated with the Commission in 1922 as superintendent of operations shortly after its inception. Three years later he was given charge of construction of rural lines as well, and carried on in these capacities until 1939 when he was appointed acting chief engineer. He was named chief engineer in 1941. Previous to his employment with the Commission Mr. Vandervoort was with the Hydro-Electric Power Commission of Ontario in the power operating department, prior to which he had been connected with a number of industrial firms.

Mr. Vandervoort has served as chairman of the Saint John Branch and as councillor of the Institute. Members of the Branch recently held a farewell dinner for him before his departure for the Pacific coast where he expects to make his residence.

W. D. MacDonald, M.E.I.C., has been named chief engineer of the New Brunswick Electric Power Commission to succeed G. A. Vandervoort, M.E.I.C. Mr. MacDonald graduated from the University of New Brunswick in 1923 in electrical engineering and was the winner of the City of Fredericton gold medal. During 1923-24 he was employed with Canadian General Electric Co. Ltd., in Peterborough and Toronto. For the next two years he served as electrical designer on preliminary plans for the Grand Falls power development with the New Brunswick Electric Power Commission. After working for some time as mechanical draughtsman with B. F. Sturtevant Company, Boston, Mass., he was employed with H. G. Acres and Company Limited of Niagara Falls from 1926 until 1930. One of the major jobs of the company during that period was the Grand Falls development and Mr. MacDonald served as resident electrical engineer, having supervision over the electrical installation. In 1931 he again joined the New Brunswick Electric Power Commission on loan from the Acres company and has been a staff member ever since. He has served as electrical designer, assistant superintendent of operations, superintendent of operations and maintenance and general superintendent, the latter including charge of operations, maintenance and supervision of major construction.

Dr. John Stephens, M.E.I.C., dean of engineering at the University of New Brunswick, who has been consulting engineer with the New Brunswick Electric Power Commission for some time, has been named engineer in charge of steam power development. In addition to his duties at the university, Dr. Stephens has a private practice as a consulting engineer. He was born near Dublin, Ireland, and attended Trinity College receiving there his B.A., M.A., B.Eng., M.Eng., and D.Sc. degrees. After being engaged in mechanical work in London for two years after graduation he came to Canada, becoming associated with the department of engineering at the University of New Brunswick in 1908. He has remained there since that time with the exception of the years from 1918 until 1919 when he served with the Canadian Expeditionary Force.

Electrical Commander W. H. G. Roger, M.E.I.C., manager of the electrical engineering department at H.M.C. Dockyard, Halifax, has been made an officer of the Most Excellent Order of the British Empire. His citation reads: "This officer organized and administered the electrical department of His Majesty's Canadian Dockyard, Halifax. His untiring efforts have contributed to the repair and refit of ships engaged in the Battle of the Atlantic." Commander Roger has been on active service since the outbreak of the war.

Colonel H. R. Lynn, M.E.I.C., of Thetford Mines, Que., has been active as consulting engineer on FIDO installations in the war zone. This has recently been learned from publicity which has accompanied the announcement of the use of this method of fog dispersal on airfields. Colonel Lynn, who commanded the 1st Battalion, Royal Canadian Engineers, overseas, is at present technical and military adviser to the British Petroleum Warfare Department in New York. He has been overseas on several occasions and for various lengths of time since the outbreak of war.

H. E. Brandon, M.E.I.C.

H. E. Brandon, M.E.I.C., has been appointed councillor for the Toronto Branch to complete the three-year term thus giving the Toronto Branch the third councillor to which it is now entitled in accordance with the by-laws of the Institute. Mr. Brandon represented the Toronto Branch on the council in 1943-44.

Henri Audet, M.E.I.C., recently received his degree of S.M. in electrical engineering at Massachusetts Institute of Technology, Cambridge. In addition he was made an associate member of the Society of Sigma Xi. Mr. Audet is a graduate of Ecole Polytechnique in the class of 1943.

F. W. Paulin, M.E.I.C., was awarded the degree of C.E. by the University of Toronto at the recent convocation. He holds the position of president and managing director of Canadian Engineering and Contracting Company at Hamilton, Ont.

John H. Ross, M.E.I.C., opened his office in Toronto last month, to carry on his own practice as consulting engineer. He was formerly with the Massey Harris Co. Ltd. on post-war planning.

Lieutenant - Commander (E) Philip Hughes, M.E.I.C., has recently been re-appointed to sea after spending the past three years in charge of engineering construction at Royal Canadian Naval College, Royal Roads, Victoria, B.C.

Léon A. Fraikin, M.E.I.C., is now at the head of the Industrial Section in the Belgian Government's Economic Mission in Canada at Montreal. Before enlisting in the Belgian Army in 1940 he occupied the position of acting vice-president and general manager of the Franki Compressed Pile Company of Canada Limited, at Montreal.

R. R. McLaughlin, M.E.I.C., professor of chemical engineering at the University of Toronto, was elected president of the Chemical Institute of Canada at the recent annual meeting in Quebec City.

Camille R. Hébert, M.E.I.C., has joined the B and H Metal Industries Co. Limited, Montreal, as vice-president and general manager of the firm, which is engaged in structural steel and plate work. Mr. Hébert is a graduate of Ecole Polytechnique in the class of 1936 and had been employed since that time with Lord and Company, structural steel contractors, Montreal.

Group Captain J. A. Jones, M.E.I.C., has returned to civilian life after more than five years in the R.C.A.F. During this time he has been connected with the construction programme required by the British Commonwealth Air Training Plan, first as senior engineering officer and later as director of construction, engineering and maintenance. Since November 1939 he has been located at Air Force Headquarters in Ottawa. He has now joined the staff of the Commonwealth Construction Co. Ltd., Vancouver, B.C., as chief engineer.

James S. Campbell, M.E.I.C., who has been with Defence Industries Limited, Montreal, has recently accepted the position of chief engineer with Canadian Top and Body Corporation Limited, Tilbury, Ont.

J. A. deBondy, M.E.I.C., is now associated with Hamilton Steel Foundries Limited at Winnipeg, Man. He was formerly employed as metallurgist, Manitoba Steel Foundries Limited, Selkirk, Man.

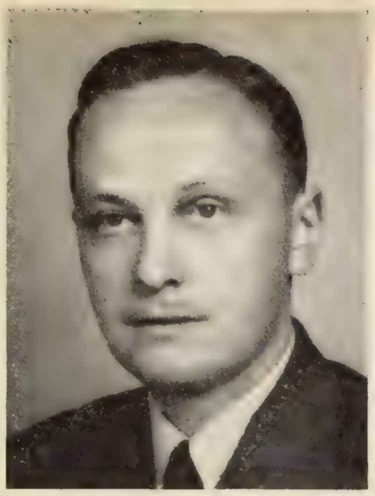
Fraser S. Keith, M.E.I.C., immediate past-president of the McGill University Graduates' Society, has been elected a graduates' representative on the board of governors of the University for a period of three years. Mr. Keith, who graduated from McGill with a B.Sc. in 1903, has long been active in the affairs of the society. He has held various posts culminating with his election to the presidency for the term 1942-44.

J. M. Jopp, M.E.I.C., has joined the staff of the Brown Corporation at La Tuque, Que., as design engineer. He was previously employed as engineer with the Abitibi Power and Paper Co. Limited, at Sault Ste. Marie, Ont.

George Knutzen, M.E.I.C., of MacLeod, Alta., has accepted the position of airway engineer with the Department of Transport, Civil Aviation Division, at Fort Wrigley, Northwest Territories.

William Walkden, M.E.I.C., bridge engineer for the western region, Canadian National Railways, with headquarters at Winnipeg, has retired after more than 38 years of railway service. He has been responsible for the design and construction of many important structures. Recently, he completed the design and construction of a 4,300-ft. trestle at Port Arthur leading to the new ore dock. Mr. Walkden started railroading with McKenzie and Mann as a draughtsman in Winnipeg in 1907, and in 1916 was made assistant engineer. In 1918 he was promoted to bridge engineer, a position he held until his retirement.

W. C. Byers, M.E.I.C., has been elected chairman of the Lakehead Branch of the Institute. Born in Rouleau, Sask., he graduated from the University of Manitoba with his B.Sc. in electrical engineering in 1934. He obtained his B.Sc. in civil engineering the following year. After graduation he was employed with the Ontario Department of Highways and with the Department of Public Works of Canada. In 1939, after some time with the Dominion Bridge Company at Winnipeg and the Department of Transport, he joined the staff of C. D. Howe Co. Limited, consulting engineers, at Port Arthur, Ont.



W. C. Byers, M.E.I.C.

Mr. Byers joined the Institute as a Junior in 1937, transferring to Member in 1944. He has been secretary-treasurer and vice-chairman of the Lakehead Branch.

P. A. Grothé, M.E.I.C., who has been serving in the R.C.A.F., has returned to civilian life and is now employed in the engineering department of the Hydro-Electric Commission of Quebec in Montreal.

I. S. Widdifield, M.E.I.C., formerly electrical superintendent of General Engineering Company, is now associated with the Hydro-Electric Power Commission of Ontario as industrial applications engineer at Toronto, Ont.

J. E. Thom, M.E.I.C., is employed in the construction department of Canadian Industries Limited at Kingston, Ont. He was previously superintendent of the plant engineering department of Defence Industries Limited, Verdun, Que.

F. G. Haven, M.E.I.C., formerly resident engineer, Civil Aviation Branch, Department of Transport, Winnipeg, Man., now occupies the position of district engineer, Department of Public Works of Canada, at Winnipeg.

Edward C. Hay, M.E.I.C., has rejoined the staff of the Canadian Westinghouse Company as an electrical application engineer, assistant to the manager of Nofuz Products Division at Toronto. He was previously employed as a staff electrical engineer with the Directorate of Electrical and Communication Design, Department of National Defence, Ottawa, prior to which he had been with the Canadian Westinghouse Company as an apparatus sales engineer in charge of their Regina office.

A. H. Paske, M.E.I.C., of the Canadian Industries Limited, has been transferred from the Windsor branch, where he was resident engineer, to the engineering department of the company's headquarters in Montreal. He will work on the nylon plant extension at Kingston, Ont.

T. B. Harrison, M.E.I.C., has recently joined the staff of the fuel department of Atlas Steels Ltd. at Welland, Ont. He was formerly test engineer at the Brunner, Mond Canada Limited, of Amherstburg, Ont.

F. J. Ryder, M.E.I.C., of Canadian Bridge Company Limited at Walkerville, Ont., has been transferred from sales engineer in the estimating department to the position of assistant superintendent of Plant One.

W. R. Stickney, M.E.I.C., vice-chairman of the Border Cities Branch of the Institute, has accepted the position of welding engineer with Canadian Vickers Company Limited, Montreal. He had been associated with the Canadian Bridge Company Limited at Walkerville, Ont., since 1937.

Harold D. Acres, M.E.I.C., is now employed in the engineering department of the E. B. Eddy Company Limited, paper manufacturers, at Ottawa, Ont. He was formerly assistant chief engineer with Clare Shipbuilding Co. Ltd., Meteghan, N.S.

Major Jacques Déry, Jr.E.I.C., who returned to Canada in March after having been overseas for five years, has now returned to the Department of Public Works of Canada in Montreal.

Flying Officer R. W. Franklin, Jr.E.I.C., has recently been released from the R.C.A.F. and transferred to the reserve. He has accepted a position as junior hydraulic engineer with the Water Resources Branch, Department of Mines and Natural Resources, Province of Manitoba, at Winnipeg, Man.

Gérard Lapointe, Jr.E.I.C., has entered private practice as a partner in the firm The Key Engineers Reg'd, consulting engineers and contractors, Montreal. A graduate of Ecole Polytechnique in the class of 1938, he was connected for some time with the engineering department of the City of Montreal as assistant engineer in the Sewers Commission. Afterwards he became construction engineer with McColl-Frontenac Oil Co. Ltd. at Montreal. More recently he has been engaged in light construction work.

C. G. Biesenthal, Jr.E.I.C., has severed his connection with the E. B. Eddy Company at Ottawa, Ont., and is now employed by Alex Fleck Ltd. of the same city.

J. A. Maurice Levasseur, Jr.E.I.C., who has been in the electrical engineering department of Sorel Industries Limited, Sorel, Que., has recently accepted the position of draughtsman in street lighting with the City of Montreal, technical division, electrical section.

D. B. Sommerville, Jr.E.I.C., who has occupied the position of manager of the St. John Shipbuilding Division of Canadian Comstock Company Limited for the past year, has been transferred to manager of the Toronto office of the company. He has also been made director of Canadian Comstock Company Limited.

Raymond Bolduc, S.E.I.C., has been appointed technical agent with the French Supply Council and is now located at Washington, D.C. He was formerly with the Aldermac Copper Corporation, Sherbrooke, Que.

Edgar R. Lea, S.E.I.C., has joined the staff of the Canadian International Paper Company at Gatineau Mill, Que. He is employed as junior mechanical engineer working on plant layout and construction on a series of new plant additions.

Florian Leroux, S.E.I.C., has recently obtained his degree of S.M. in aeronautical engineering at Massachusetts Institute of Technology, Cambridge.

He is a graduate of Ecole Polytechnique in the class of 1943.

D. D. Love, S.E.I.C., a student in mechanical engineering at McGill, is employed during the summer months as assistant engineer in the millwright division (aluminum plant), mechanical department of the Aluminum Company of Canada Limited at Arvida, Que.

Colonel C. H. Drury, O.B.E., S.E.I.C., former assistant adjutant and quartermaster general of the Canadian Fifth Armoured Division, has been promoted from the rank of lieutenant-colonel. He has been appointed to the Headquarters Staff of the Canadian Far East Force.

Colonel Drury, who is only 28 years of age, recently returned from overseas after nearly five years service. A brilliant record at Lower Canada College, where he won many awards, was followed by outstanding success at the Royal Military College, Kingston, where he graduated with honours in 1938 when he was battalion sergeant major, and was awarded the Sword of Honour, highest award of the college. In the following year he received his degree of Bachelor in Chemical Engineering at McGill University.

Colonel Drury joined the non-permanent active militia and was identified with the 2nd Montreal Regiment, R.C.A. He volunteered for active service at the outbreak of war, was commissioned shortly and promoted to captain one year later. He went overseas in 1940 and two years later became acting major on appointment as deputy assistant quartermaster general to the Fifth Division. He was promoted to lieutenant-colonel in 1943 and appointed assistant quartermaster general of the First Canadian Army Corps. His appointment as assistant adjutant and quartermaster general of the Fifth Division came in 1944 and in April, 1945, he was made an Officer in the Order of the British Empire for his services.

Captain D. J. McIntyre, S.E.I.C., has been released from the Army and is now employed as production engineer for National Pressure Cooker Co. Ltd. at Wallaceburg, Ont. A graduate of Queen's University in 1940, he enlisted as a lieutenant in the Royal Canadian Engineers in December of the same year. In November 1944 he was wounded in action in Holland and received his medical discharge in April of this year.

Lieutenant (E) John M. Dyke, S.E.I.C., has recently been released from the Navy and is now employed as boiler design engineer with the John Inglis Co. Lt., Toronto, Ont.

Louis Malkin, S.E.I.C., is at present employed as a chemist with the Canadian Westinghouse Company in Hamilton, Ont.

John H. Nicholls, S.E.I.C., has enlisted in the Canadian Army and is at present training at Sussex, N.B.

J. Jaques Pichette, S.E.I.C., who graduated this year from McGill University, has joined the staff of Trans-Canada Air Lines as a mechanical engineer at Dorval, Que.

J. M. Carbert, S.E.I.C., has graduated in mechanical engineering from the University of Saskatchewan and is now associated with the National Research Council at Ottawa, Ont., as senior research assistant.

Obituaries

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

Dr. Carl Busch Thorne, M.E.I.C., former vice-president and technical director of the Canadian International Paper Company, died on July 14th, 1945, at his residence in Hawkesbury, Ont. Born in Moss, Norway, on July 28th, 1876, he attended the Technical School in Norway and received his university education at Hanover and Dresden, Germany.

On leaving university he immediately became associated with sulphite pulp manufacture and worked for a number of years as both chemist and engineer. In 1902 he came to this continent to study American methods of pulp and paper manufacture and, in the following year, after having visited practically all the sulphite mills in the eastern part of the United States, joined the staff of the Riordon Pulp & Paper Company, Limited, as engineer and sulphite pulp expert for their mills at Hawkesbury and Merritton, Ont. He was appointed manager of the Hawkesbury mill in 1905 and was later entrusted with the management of the Merritton mill. From then on he acted as technical director and vice-president of the company.

In 1913 the idea was conceived of building a new mill which was to manufacture sulphite pulp particularly suited for use in the manufacture of rayon. After careful study it was recommended that the new mill be located at Temiskaming, Que., as the quality of northern Canadian spruce in that locality was found to be most suitable and the available water supply gave the desired analysis. A new company was started and Dr. Thorne was made responsible for the design and construction of the mill and power plant, Kipawa Mill, as well as of the model town of Temiskaming, Que. He was responsible for its operation from the start until the end of 1944 when he retired from active operation. In 1919 he was elected vice-president of the Kipawa Company and after the acquisition of the Riordon properties by the Canadian International Paper Company, became vice-president and technical director.

An interesting story of Dr. Thorne's activities may be read from his numerous patents. It shows that he devoted thought to many phases of the pulp manufacturing process, making them the subject of valuable improvements. In this connection may be mentioned machines for the retention of fibre material (Saveall), water filters, and a mechanical indicator for fibre losses. In 1912 he conceived the idea of replacing the old wooden acid towers by reinforced concrete construction and erected the first concrete acid tower at the Hawkesbury mill. These towers, now known as "Jenssen Acid Towers", were generally accepted by sulphite mills the world over. Much time was devoted to the reduction of the enormous waste of sulphur and Dr. Thorne's endeavours led to a then new sulphur dioxide recovery system, a system which was gradually adopted and further developed by other Canadian and American mills. Another item to attract his attention was wood preparation, and a study of the barking of wood led him to the invention and construction of the Thorne Log Barking Machine for the purpose of barking logs from 4 ft. to 16 ft. or longer. He next developed and patented a new theory and practice for bleaching fibres of wood and other materials. Dr. Thorne also constructed equipment for continuous and multiple stage bleaching. He was the first to introduce continuous bleaching in the pulp industry with his Thorne Bleaching Tower.

Dr. Thorne also recognized that development without scientific research is necessarily somewhat limited and he successfully acted upon this opinion. As a result, the Canadian International Paper Company has to-day in Hawkesbury a scientific research department of the first order.

In recognition of his many valuable contributions to the development of the pulp industry as well as of his furtherance of scientific research in this and related fields, the Technische Hocheschule (Institute of Engineering) of Darmstadt, Germany, on the occasion of its centennial celebration, conferred upon Dr. Thorne the degree of Doctor of Engineering honoris causa. In 1937 the Technical Association of the Norwegian Paper Industry presented Dr. Thorne with a diploma attesting his appointment as honorary member.

In 1934 Dr. Thorne was created a Knight Commander of the Royal Norwegian Order of St. Olav by King Haakon, for furthering Norwegian interests in Canada. Four years later he was awarded the gold medal of the Technical Association of the Pulp and Paper Industry, New York, "in recognition of his outstanding contribution to technical development of the pulp and paper industry".

Dr. Thorne presented to the Town of Temiskaming a fountain of Florentine marble set on a base of red granite from New Brunswick. The figures are cast in bronze. Another gift from him which adds much to the beauty of the town is an ancient well-head cast in bronze. Both pieces came from a famous Italian estate.

Among Dr. Thorne's contributions to the pulp and paper industry is included his activity in helping to organize and carry on the work of the Technical Section of the Canadian Pulp and Paper Association, of which he was a councillor and officer for many years. He was deeply interested in the establishment of the Pulp and Paper Research Institute of Canada and the work of the Forest Products Laboratories.

Dr. Thorne joined the Institute as a Member in 1914.

LeRoy Egerton Westman, M.E.I.C., president of Westman Publications Limited, died suddenly in Toronto, Ont., on July 1st, 1945. Born at Granton, Ont., on June 28th, 1890, he received his education at Stratford, Ont., and at the University of Toronto where he graduated with the degree of M.A. in 1914.

In 1914 he was engaged by the Dominion government as a public analyst and in the following year was chemist in charge of Inspection Laboratory in New York. From then until the end of the first world war he was employed by the Dominion government or on loan to other organizations. Early in 1918 he returned to the University of Toronto as chief demonstrator, department of chemistry in charge of training undergraduates for war industries.

In 1919 Mr. Westman became editor of *Canadian Chemistry Journal* now *Canadian Chemistry and Process Industries.*

During the academic years of 1920-22 he lectured on chemistry of food and nutrition at Ontario College of Dentistry. He organized Cheney Chemicals Limited and established the manufacture of nitrous oxide in Canada. He was actively associated with the construction of a wood flour plant, grinding wood flour suitable for use as filler in synthetic resins.

L. E. Westman, M.E.I.C.

Mr. Westman entered the Department of Labour in the early days of the formation of the Wartime Bureau of Technical Personnel, in 1941. He was one of those closely connected with the organization of the Bureau and previous activities relating to surveys of engineers, chemists and science workers from the standpoint of wartime needs. He represented the Department of Labour in the development, in conjunction with the Departments of National Defence and Munitions and Supply, of the University Science Students' Regulations, subsequently incorporated in Selective Service man-power regulations and placed under the administration of the Wartime Bureau of Technical Personnel. He also acted for the Director of National Selective Service in the Canadian Medical Procurement and Assignment Board. In 1943 he was appointed Associate Director of National Selective Service in charge of matters relating to war industries, from which position he had retired on June 30th, the day before his death.

For many years Mr. Westman was associated closely with the activities of the chemical societies in Canada. He was secretary of the Canadian Institute of Chemistry from 1921 until 1936 and was a leader in the movement to bring all chemical organizations together into one society. The recent inauguration of the Chemical Institute of Canada marked the successful culmination of his long years of effort in this endeavour. In 1944 he was elected president of the Canadian Institute of Chemistry and chairman of the interim council of the newly formed Chemical Institute of Canada.

Mr. Westman was a member of the Engineering Institute Committee on the Engineer in the Active Services and the Plummer Medal Committee. He joined the Institute as a Member in 1941.

George Laing Brown, M.E.I.C., died at his home in Morrisburg, Ont., on January 6th, 1945. Born in Winchester, Ont., on January 2nd, 1864, he attended the Ottawa Normal School and taught for a number of years on the public school staffs at Ottawa and Morrisburg before taking up the study of engineering. He attended the University of Toronto and graduated as a civil engineer in 1893, later obtaining his O.L.S. and D.L.S. certificates. He did considerable engineering work in northern Ontario but the bulk of the work to his credit was done in the county of Dundas. Several drainage works stand as a monument to his professional skill. He served as engineer for the Town of Morrisburg as well as for a number of surrounding townships. He was also employed by the provincial government to survey a number of townships in northern Ontario.

Mr. Brown joined the Institute as an Associate Member in 1907 and was made a Life Member in 1932.

George G. Fitzgerald, M.E.I.C., died at his home in Regina, Sask., on May 5th, 1945. Born at Bailieboro, Ont., on September 19th, 1878, he attended the School of Science, University of Toronto.

From 1898 until 1901 Mr. Fitzgerald was employed on Dominion land surveys in British Columbia. The three years following were spent as draughtsman with International Harvester Company of Chicago. In 1905 he accepted employment with the Commonwealth Edison Company of Chicago as field engineer on the location and construction of cable tunnels, steel tower transmission lines, underground conduit lines and overhead distribution lines. He remained with this firm until 1918 when he became associated with Ross & MacDonald, architects, of Montreal. His position was that of engineering draughtsman on heating, ventilating, plumbing and boiler plant layouts for various military camps, Toronto Union Station and Halifax Ocean Terminals. During 1919-20, he was employed by Russell and Roddick, contractors, Toronto, as engineer on construction work for the Toronto Harbour Headwall contract. Mr. Fitzgerald then accepted the position of supervisor of manual training of the Regina Public Schools which position he held until his retirement in 1944.

Mr. Fitzgerald joined the Institute as an Associate Member in 1924, becoming a Member in 1940.

Alfred Adolf Julius Westman, M.E.I.C, died on June 22nd, 1945, at his home in Montreal, Que. Born in Moscow, Russia, on June 23rd, 1877, he studied at the Sweden Norther College in Stockholm before going to the United States.

From 1907 until 1910 he worked for General Electric Company in Schenectady, N.Y. In 1914 he joined the Montreal Public Service Corporation and two years later was transferred to the Montreal Tramways Company. He became electrical engineer of the latter company in 1927 which position he held until his death.

Mr. Westman joined the Institute as a Member in April 1945.

Lieutenant Norman Llewellyn Prideaux, S.E.I.C., was killed in action on April 23rd, 1945, while serving with the Seaforth Highlanders of Canada, in the western European theatre of war.

Born in Toronto, Ont., on November 25th, 1919, Lieutenant Prideaux graduated from the University of Toronto in 1942 with the degree of B.A.Sc. (Civil). For two summers he had been employed by the Department of Transport as instrument man on the construction of airports and in the summer of 1941 he was superintendent in charge of construction for the Ontario Construction Company Limited at St. Catharines Airport. During the academic years of 1941-42, while still attending university, he held the position of teacher of applied mechanics of the night class at Central Technical School, Ontario. On graduation he enlisted in the No. 1 Canadian Engineers Reinforcement Unit and went overseas in 1943.

Lieutenant Prideaux joined the Institute as a Student in 1941.

Frederick Theodore Gnaedinger,, M.E.I.C., died on June 9th, 1945, at the Western Hospital, Montreal. Born at Montreal on August 2nd, 1889, he graduated from McGill University in 1912 with the degree of B.Sc. (Met. Eng.).

After working for some time with the Algoma Steel Company at Sault Ste. Marie he was employed by the Lake Superior Paper Company, now the Spanish River Pulp and Paper Mills, Limited, as draughtsman and field engineer. In 1913 he was engaged on hydro-electric power investigation for the Mond Nickel Company, and in the two succeeding years was resident engineer on the construction of the power development at Nairn Falls, Que. Before enlisting with the Canadian Railway Troops in 1916 he spent some time with New Brunswick Metals Limited as metallurgist and smelter superintendent in mining and smelting antimony at Lake George, N.B.

On being demobilized in 1919, Mr. Gnaedinger became associated with the Algoma Steel Corporation on the construction of a new combination rail and structural mill. In 1922 he accepted the position of resident engineer for T. Pringle and Son, Limited, of Montreal. He remained with this firm until his death at which time he held the position of project engineer.

Mr. Gnaedinger joined the Institute as a Student in 1911, transferring to Junior in 1916 and to Associate Member in 1921. He became a Member in 1940.

News of the Branches

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

BORDER CITIES BRANCH

F. J. Ryder, M.E.I.C. - *Secretary-Treasurer*
J. G. Hoba, Jr.E.I.C. - *Branch News Editor*

The day June 6th 1945 will long be remembered by the members of the Border Cities Branch as being very successful and entertaining. Dean Fetherstonhaugh and his party, which included Mrs. Fetherstonhaugh, Dr. L. A. Wright, Mr. J. M. Vance and Major D. C. MacCallum motored to Windsor from London on that date for the president's annual visit.

The day's events began early for Mrs. Fetherstonhaugh when she was entertained at the Essex Golf and Country Club by the ladies of the executive, under the chairmanship of Mrs. G. G. Henderson. Also participating in the party were Mrs. T. H. Jenkins, Mrs. A. L. Johnston, Mrs. W. R. Stickney and Mrs. F. J. Ryder.

The men of the visiting party in conjunction with the Border Cities Branch executive and other invited guests were entertained at a luncheon at the Canadian Bridge Company, where Mr. St. Clair Ryley was the host at a very fine luncheon. Branch Chairman A. H. MacQuarrie presided.

At the conclusion of the luncheon many of those present took the opportunity of visiting the new grain elevator being erected on the Detroit River for Hiram Walker & Son Grain Corporation Limited. Here Mr. Gerry Ryley of the C. D. Howe Company, engineer on the project, was the host and pointed out the highlights in the construction of the 1,100,000 bushel capacity grain elevator. The building is constructed of re-inforced concrete with 33 bins 90 feet high and a marine tower 176 feet high. There have been facilities provided to load and unload both railway cars and steamships. The handling capacity of either loading or unloading a steamship is at the rate of approximately 20,000 bushels of grain per hour. The construction work is being done by the Piggott Construction Company of Hamilton.

Approximately 100 people sat down to dinner in the evening in the main ballroom in the Prince Edward Hotel. Many of the members had their ladies with them and the general opinion among the ladies was that henceforth the president's visit should be a "Ladies Night". The evening had the aspect of an International Night since among the head table guests were: Mr. A. C. Pasini, president, Mr. Hanson, vice-president, and Mr. R. K. Welby, secretary-treasurer of the Detroit section of the American Society of Mechanical Engineers. A. H. MacQuarrie was the chairman of the meeting and G. G. Henderson, councillor of Windsor Branch, introduced the speaker of the evening.

Dean Fetherstonhaugh addressed the group on the very timely and far sighted subject of **Humanitarian Studies**, which included English, political economy, government and labour problems.

Also addressing the meeting were Major D. C. MacCallum who spoke on the work that is being carried on by the Institute to help returned veterans, Dr. L. A. Wright who spoke about matters of importance to the Institute and outlined the work carried on by headquarters staff, and J. Clark Keith, who thanked the speaker. Following the dinner an informal meeting was held at which the visitors from headquarters staff, visiting members from the American Society of Mechanical Engineers and the Branch executive discussed a proposed joint meeting of the two organizations to be held in October at the Rackham Building in Detroit at which it is hoped that General McNaughton will be the guest speaker.

HAMILTON BRANCH

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

On Friday, June 8th, 1945, sixty-five members of the Institute from Hamilton and the surrounding district gathered at the Scottish Rite Club to honour at dinner the president of the Institute, Dean E. P. Fetherstonhaugh. N. Eager, branch chairman, opened the meeting and officially welcomed the president to Hamilton. President Fetherstonhaugh was introduced to the assembly by H. Chambers.

By virtue of his position as dean of engineering and architecture at the University of Manitoba, the president was well qualified to present to the meeting his thoughts on the future trends in engineering education.

The problem of revising engineering curricula has been under consideration for some time by numerous individuals and groups concerned with engineering education. The almost unanimous conclusion reached has been that engineering courses given in the future must devote considerably more time to studies of the "humanities". Several schemes have been advanced for the accomplishment of this suggestion both by increasing the length of the course to five years, and by reducing the proportion of technical studies.

Statistics have shown that a large number of graduate engineers of approximately ten years' standing or more, find themselves required to do a considerable amount of administrative work and that their purely technical efforts were considerably reduced. In order to fit the young engineer for such work in the future, Dean Fetherstonhaugh felt that more administrative training should be added to engineering courses. Such studies might well be introduced gradually and the engineering curriculum enriched by the inclusion of English, Economics, Politics, Labour Relations and Management courses. The president did not feel that the present conditions warranted an increase in the length of the University course, but rather suggested that the practical work be condensed in such manner as to allow approximately one-quarter of the total time for studies relating to the liberal arts.

The services of Canadian engineers during the war have been gratifying to those who have trained them but their experiences had corroborated the conclusions reached by educators that much can still be done to improve the standards of engineering education and to provide training other than the purely technical.

At the conclusion of his talk, Dean Fetherstonhaugh was thanked by N. Eager, branch chairman.

Dr. L. Austin Wright, general secretary of the Institute, spoke at some length on proposed amendments to the constitution. Expanding actiivties of the Institute have indicated the need for additional finances and it has been proposed that Institute fees be increased. A number of recommendations concerning the elimination of transfer fees and the automatic transfer of members to a higher category as they attain the present age limit, have been made.

It is the intention of the Institute to establish an Annual Student Conference with delegates from all Canadian Universities. The delegates, the presidents of their respective Undergraduate Engineering Societies, will meet annually at the General Meeting. This proposal has met with an enthusiastic response and Undergraduate Engineering Societies have offered to shoulder a portion of the expenses which will be involved.

Major D. C. MacCallum, the Institute's Rehabilitation Officer, explained the work of the rehabilitation service undertaken in co-operation with the Wartime Bureau of Technical Personnel. Major MacCallum stated that the Institute endeavoured to provide information regarding jobs and studies available to approximately 1,200 members of the Institute now in the Armed Services. The services supplied by the Institute to these members were not felt to be duplications of the services offered by other agencies, as members of the Institute were being contacted prior to their return to this country.

Dean Fetherstonhaugh presented a certificate to Robert J. G. Schofield, Jr. E.I.C., for his paper entitled " Cotton Yarn Dyeing ". Similar certificates were presented, in absentia, to Andrew M. Swan, S.E.I.C. for his paper " The Application of Electric Drive to Machine Tools ", James C. Buchanan, S.E.I.C. for " Economical Use of Power Hack Saw Blades ", and Kenneth R. Knights, S.E.I.C. for his paper, " Electronics as Applied to Spot Welding ".

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 in the Royal Edward Hotel, Fort William, on June 27th. S. T. McCavour presided at the meeting and briefly reviewed the year's activities. The officers were elected for 1945-46. Reports of committees were presented by the respective chairmen. J. I. Carmichael presented the secretary's report. Mr. McCavour introduced the new chairman, W. C. Byers, who spoke briefly.

Three coloured films showing the natural beauty of the Lakehead district, the movement of iron ore from mine to smelter, and tropical fishing were shown by Jack Fryer of Fort William.

R. B. Chandler expressed the thanks of the Branch to Mr. Fryer and resolutions of appreciation were tendered the chairman and retiring officers for service during the year.

LONDON BRANCH

A. L. Furanna, m.e.i.c. - *Secretary-Treasurer*
G. N. Scroggie, m.e.i.c. - *Branch News Editor*

On June 5th, President Fetherstonhaugh, accompanied by Mrs. Fetherstonhaugh, Dr. L. Austin Wright, and Major D. C. McCallum, paid his visit to the London Branch.

The party arrived from Montreal by train, and were met at the station by Councillor J. A. Vance, Branch Chairman H. G. Stead, and their wives. They accompanied the party to the Hotel London where they had luncheon with several members of the Branch Executive.

During the afternoon President Fetherstonhaugh and his party made a tour of several points of interest in the city, and visited the University of Western Ontario.

In the evening a dinner was held at the London Hunt and Country Club, where members of the local Branch and their wives had the opportunity of meeting the president and Mrs. Fetherstonhaugh.

Following dinner, J. A. Vance introduced the president who spoke on **Engineering Education**. He paid fitting tribute to the late Harry F. Bennett, who was chairman of the Young Engineer Committee. E. V. Buchanan, thanked the president, and the chairman, H. G. Stead, introduced the general secretary, Dr. L. Austin Wright, who spoke briefly but pointedly on such matters as the Quebec architect versus engineer, fees, the *Journal*, etc. Dr. Wright in turn introduced Major MacCallum who spoke on the rehabilitation of the engineers who would be returning from overseas.

This was the first " Ladies' Night " during the past few years.

PETERBOROUGH BRANCH

Eric Whiteley, m.e.i.c. - *Secretary-Treasurer*
J. F. Osborn, jr.e.i.c. - *Branch News Editor*

A paper **Clad Steels** was presented by Mr. E. C. Gosnell before the April 12th meeting of the Branch. Mr. Gosnell, manager of the chemical division, Lukens Steel Company, dealt chiefly with the applications for clad steels, but also described some manufacturing details of this homogeneously bonded material.

Clad steels have come into use because corrosion resistant materials are needed for industrial lining materials. In particular, the manufacture of synthetic rubber, plastics, high octaine gasoline, dehydrated foods and industrial chemicals call for metal vessels which do not cause contamination, but the cost of which is within reasonable bounds. Equipment made of solid corrosion resistant metals would be prohibitive in costs.

Nickel clad steels were developed first in response to the requirements of the alkali producers as a means of increasing the purity of caustic soda. Later, it was found possible to make monel clad, inconel clad, stainless clad and silver clad. In the manufacture of clad steels, blocks of liner material are welded to steel plates, then two plates welded together at the edges with the corrosion resistant sections to the inside and separated by parting material. This is done to prevent impurities being rolled into the clad surface. After rolling to the proper thickness the edges are sheared and the plates separated.

Certain precautions should be taken in applying clad materials. The appropriate corrosion resistant metal must be selected. Butt type electric welding should be employed for fabrication with as few fillet welds as possible. Possibility of galvanic corrosion due to similar metals should be borne in mind, especially in the choice of accessory parts. Nature, concentration and temperature of corrosive materials are factors as are mechanical effects of flow.

Slides and moving pictures were used effectively in illustrating this paper.

VANCOUVER BRANCH

J. G. D'Aoust, M.E.I.C. - *Secretary-Treasurer*
P. B. Stroyan, M.E.I.C. - *Branch News Editor*

On June 14th about one hundred members, wives and friends of the Vancouver Branch met in the Pavilion in Stanley Park for the annual "Ladies Night." Mr. Oscar Olson, local business executive and amateur photographer, presented coloured films taken on his various trips throughout British Columbia, depicting the gorgeous scenery for which this western province is justly famous. Other films gave a pictorial description of the logging industry on the coast, all with an interesting commentary by Mr. Olson.

By way of entertainment local artists presented a programme of songs from light operas and from current stage hits. Refreshments were served at the end of the evening.

These annual get-togethers have proven so successful that they are now fixtures on the calendar of the Vancouver Branch activities.

SAGUENAY BRANCH

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

President E. P. Fetherstonhaugh, visited the Saguenay Branch on Monday, 18th June, 1945. He was accompanied by Mrs. Fetherstonhaugh, and Assistant General Secretary Louis Trudel. Dean D. S. Ellis, Dean of the Faculty of Applied Science of Queen's University at Kingston, was in the district at the time and accompanied the party on the various tours.

In the forenoon a tour was conducted through the Arvida Works of the Aluminum Company of Canada Limited, and at noon the presidential party was entertained at a luncheon attended by the members of the branch executive and their wives. The presidential party and a number of the branch members were conducted through the Shipshaw Power Development of the Aluminum Company of Canada, Limited in the afternoon, while other members attended a conducted tour through the Kenogami Pulp and Paper Mill of Price Brothers and Company Limited.

At a dinner meeting held in the evening in the grill room of the Saguenay Inn, President Fetherstonhaugh was the principal speaker. He was introduced by Councillor A. Cunningham.

The president paid tribute to the engineers of the Saguenay district in view of the magnitude of their contribution to the war on the home front, and to the work of the numerous committee members of the Institute, whose work was entirely voluntary, and whose number varied between four hundred and five hundred. He then cited several examples, illustrating the strides taken by the profession of engineering over the period of the past five years.

The president's main topic was the trend in engineering education. He pointed out that a large portion of the men graduating in engineering eventually assumed positions of management, and stated that there was a definite trend towards increased education in the humanities. There was no doubt that the increased education along the lines of public speaking, management, public relations, and the government were all of advantage to engineers, but at the same time the basic principles of engineering could not be neglected. Since the engineering course is already a heavy one, it is difficult to find room for additional studies. These could be accomplished by means of increased preliminary education, either in high school, or in an arts course, or by increasing the engineering course from four to five years. However, this was not believed advisable at the present time, in view of the number of men who were returning from the armed services and who would be resuming their interrupted education, and could not be expected to take an extended course before assuming their places in civil life.

The second speaker was Mr. McNeely DuBose, vice-president of the Aluminum Company of Canada, Limited, and past vice-president of the Institute, who dealt briefly on the outlook for the future. He stated that the two main motivating influences were "hope" and "fear", and that at the present time the influence of "fear" was predominant throughout the world. The motivating influence of the engineering profession, however, was "confidence" in the future and hope of "reward", and that the greatest forward steps were made during the periods of prosperity. Care would therefore have to be taken to ensure that the motive of "fear" was not allowed to proceed to the extent that future development would be in danger.

Dean Ellis, paid tribute to the work of the Institute in fostering the spirit of fellowship amongst the engineers. Dealing with his work on the Advisory Board of the War Time Bureau of Technical Personnel, he stated that after considerable trouble, the necessary information had been secured, and that priorities had been set up for the armed services, and for industry. One of the outstanding policies was that of preventing the enlistment of students registered in engineering. This policy was not followed in the United States, with the result that they are now faced with a shortage of trained engineers for industrial work. Dean Ellis has also been a member of a committee which was endeavouring to improve the position of engineers serving with the Engineering Corps, which has been associated with the Ordnance Corps. In view of the fact that senior officers were ordnance men, the progress had been difficult, but it was now felt that tangible results had been achieved, and that the constitution of the Engineering Corps would in the future be along lines of the Royal Electrical and Mechanical Engineers. Dean Ellis emphasized the remarks of the president, with regard to the participation of engineers in the social services.

Assistant General Secretary, Louis Trudel, gave a report from headquarters. He stated that the membership had passed the 7,000 mark, and that the trend was still upwards. He stated that the finances of the organization were in good order, but that they were being strained by new services being assumed by the Institute, and that there was a possibility of an increase in membership dues. An illustration of this was the rehabilitation programme for engineers in the armed forces, for which the Institute had not been prepared financially. It had been necessary to resort to a voluntary subscription on the part of the membership at large, and the result of this canvass had been very gratifying.

A field in which the engineers would be expected to play a large part in the near future is that of community planning, and considerable work has already been done along these lines.

With regard to the agreement with the Corporation of Professional Engineers of Quebec, Mr. Trudel stated that by agreement of both Councils, the period for application by members of either organizations for membership in the other, has been extended to the end of the year.

J. B. Hayes, president of C.E.A., President E. P. Fetherstonhaugh, J. O. Martineau, chairman of Quebec Branch, E. V. Caton of Winnipeg, vice-president of C.E.A.

President J. B. Hayes of C.E.A. On his right: H. E. Parson, vice-president of C.E.A.: Councillor P. E. Poitras of E.I.C.

L. Austin Wright, B. C. Fairchild, E. D. Gray-Donald, P. E. Gagnon, René Dupuis.

(Above) A group from Quebec Power Company.

(At left) Charles Taschereau, Alex Larivière, Huet Massue, Dean Adrien Pouliot of Laval, Louis Beaudry, Hector Cimon.

PRESIDENTIAL VISIT TO SAGUENAY BRANCH

President Fetherstonhaugh chats with Chairman Booth.

From left to right: Past Vice-President McNeely DuBose, the president, Chairman K. A. Booth.

Councillor Adam Cunningham thanks the president. On his right: A. C. Johnston.

Past-Councillor J. W. Ward puts one up to Charles Miller.

(At left) Past-Councillor N. F. McCaghey and Fred Boutilier listen intently to the president.

N. F. McCaghey, on behalf of the local branch, thanked the president and other speakers for their contributions to the meeting.

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At a meeting of the Saguenay Branch on June 28th, 1945, Mr. Perry Peterson, president of Control Corporation, Minneapolis, Minn., delivered a paper entitled **Centralized Control of a Power System.**

Mr. Peterson stressed the importance of maintaining the continuity of electrical service and of the necessity of being able to sectionalize a power system in cases of trouble, factors which could be greatly improved by means of centralized control. The speaker had a complete supervisory unit, both sending and receiving units, and illustrated his talk by means of practical demonstration. He demonstrated how high circuit-breakers could be operated from the central station, the voltage could be regulated and load adjusted, proper signals received at the central station. He also demonstrated how control could be changed from the central station to the remote station; how operations could be performed manually at the remote station, and the indication received at the central station when circuit-breakers were opened either manually or by relay; the indication received when the communication lines were out of order and the check which could be made when communication was restored.

He explained that the operations were performed by means of audio-frequency signals, either singly or in combinations, and explained that a check could be made on as many as 150 circuit-breakers in a matter of six seconds.

Mr. Peterson then explained the automatic synchronizer, which could be made to parallel two systems when the synchronous speed was reached. This was accomplished by means of photo-electric cells which received signals based on the phase relation and relative speeds of the two systems. If required, relative speed indicaion could be transmitted to either station.

Mr. Peterson then described several types of telemetering, dealing chiefly with the variable condenser type, in which the moving element of the primary instrument varies the capacity of two tune circuits. These two resulting frequencies are then mixed and the beat frequency transmitted to the receiving station, which converts the frequency received to a milliammeter reading which is calibrated according to the indication on the primary instrument.

After answering a number of questions, Mr. Peterson was thanked on behalf of the Branch by C. Miller.

* * *

A meeting of the Saguenay Branch held in the grill room of the Saguenay Inn on July 3rd, 1945, was addressed by Mr. J. Thwaites, development engineer of the Canadian Westinghouse Company, Ltd., of Hamilton, Ont., on the subject **England in Wartime**. Mr. Thwaites was introduced to the meeting by W. Fraser.

Mr. Thwaites explained that in December, 1943, he had gone to the United States and had later been assigned technical adviser to the United States Army Signal Corps. He had been asked to design a secret device which was so secret that, after working on the design for two months, he still did not know what it was for except that it had to be delivered in England by April 15th, 1944. It later developed that the device was a radio transmitter, which was intended to jam the German communications on D-Day. The equipment had to be sufficiently strong to completely jam all German communication channels, but had to be installed and tested without the Germans knowing of its existence. The equipment was so successful that the German radio communications were completely jammed for thirty-six hours following D-Day. This equipment was later adapted to the destruction in mid-air of V-Bombs and V-2 Rockets. The detonation of the latter was carried out by means of an electronic device, which could be operated by false signals supplied to it from the transmitter on the ground. Later the predictors were developed to the point where 85 per cent of the V-Bombs were being shot down at the coast by means of anti-aircraft fire averaging three shots per bomb.

Mr. Thwaites described the application of some of the radar equipment as applied to naval units. He stated that the equipment was accurate in range to within twenty yards, and to within two seconds of arc.

Mr. Thwaites then described some of the conditions existing in wartime England. He paid tribute to the English theatre as an excellent morale builder. He told of the bomb damage in London, Birmingham and Manchester, and commented on the casual attitude of the English people towards the bombs and rockets. He stated that civilian casualties were much higher than indicated by official figures, since these included only those which had been definitely accounted for.

Rationing in England was, and still is, very severe. One person is allowed 48 clothing coupons per year, 12 coupons of which are required for a cotton dress, 30 coupons for a man's suit, and one coupon for a handkerchief.

In the canteen Mr. Thwaites was told that it was necessary to serve 24 people from one pound of meat, including bone and scrap. The ice-cream was made from potatoes, a saccharin solution, and colouring matter, which had been frozen. Candy is regarded as an excellent energy food, and each person is allowed twelve ounces of candy per month, if it can be obtained. Mr. Thwaites described the British chocolate as being tough, fibrous, and definitely not palatable.

The speaker was thanked by Tom Carter on behalf of the assembly.

SAINT MAURICE VALLEY BRANCH

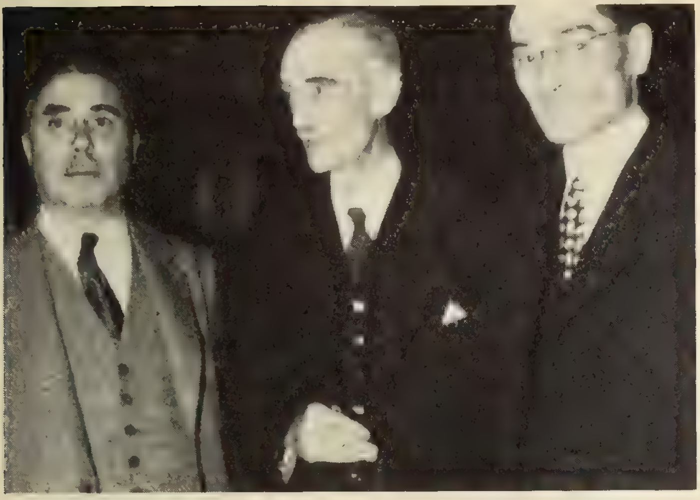
Allan Holder, M.E.I.C. - *Secretary-Treasurer*

The annual meeting of the Branch was held on June 12th at the Cascade Inn in Shawinigan Falls. Among those present were Dr. E. P. Fetherstonhaugh, president of the Institute, Louis Trudel, assistant general secretary, and P. E. Poitras, president of the Corporation of Professional Engineers of Quebec.

During the evening the new officers of the Branch were elected. The dinner was presided over by the retiring chairman, Robert Dorion, and the incoming chairman, H. K. Wyman. Mr. Dorion welcomed the members and guests and thanked his executive for their co-operation during the past year.

The secretary's report revealed that the Branch was making good progress and that the membership had increased during the year. The St. Maurice Valley Branch now boasts of 93 members, 44 of which are from Shawinigan Falls, 22 from Three Rivers, 15 from Grand'Mere, 10 from La Tuque and Rapide Blanc and two others. Mr. Dorion then gave the chair to Mr. Wyman who introduced the president.

THE PRESIDENT AT SHAWINIGAN FALLS



Left to right: Retiring Chairman Robert Dorion, the president, Incoming Chairman H. K. Wyman.

Left to right: J. S. Whyte, Past-Councillor J. H. Fregeau.

(At left) Eric Wheatley, Councillor John Wickenden, Viggo Jepsen.

President Fetherstonhaugh spoke in French and expressed his happiness at being in Quebec, the province in which he was born. He said he appreciated the competency of the executive in the various sections and was happy to note the progress in Shawinigan Falls since his last visit. The speaker recalled his experiences in the scientific and engineering domain for the past 50 years, and of the bright future for young engineers of to-day. Dr. Fetherstonhaugh spoke of the fine co-operation existing between the Corporation of Professional Engineers of Quebec and the Institute. He expressed his pleasure at the reception given his party at Shawinigan Falls.

John Wickenden of Three Rivers thanked the speaker and referred to Dr. Fetherstonhaugh's 50 years of service in the engineering profession as an example. He stated that the progress already made permits us to expect considerable expansion in the future.

Mr. Poitras spoke of the good feeling between the Institute and the Corporation stating that both organizations have everything to gain in such co-operation.

Mr. Trudel enumerated the activities of the headquarters of the Institute for the past year.

Library Notes

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

BOOK REVIEW

THE NEW CITY: PRINCIPLES OF PLANNING:

L. Hilberseimer, with an introduction by Mies van der Rohe. Chicago, Paul Theobald; Montreal, Cambridge Press, 1944. Canadian Price $7.75.

Reviewed by Stewart Young, M.E.I.C., Director of Community Planning, Saskatchewan.

"City Planning," states the author, "is a social task," and, from earliest times, environment, and the activities conditioned by it, have influenced the creative spirit of man and moulded the intrinsic character of the communities he builds.

Modern ethnology, continues the author, recognizes two basic types, the peasant and the nomad, each with his own cultural development; the one, "organic" in outlook, bound to the soil and thinking in terms of plant life; the other, from the exigencies of life tending to the "geometric". These basic elements appear in all communal developments, either separately or together. "Organic" communities are slow in growth and are based on the voluntary coalition of citizens. On the other hand the tented camp of the nomad shows in simplest form the co-ordinating principles of the "geometric" city.

The author states further that geographical location and topographical conditions are decisive factors in the choice of site and development of all communities, the earliest of which arose in valleys, watercourses and on sea coasts along natural lanes of communication.

Tracing the stages of industrial development from the home work shop to the present day system of mass production and distribution, he then proceeds to analyse their affect on community life and offers new and interesting methods of solving the problems involved in urban development.

While the student of this vital and important phase of the development of our national life may not agree on the practicability of some of the conclusions of the author, the approach is, nevertheless, new, stimulating and evidences a wide knowledge of the subject with logic born of a deep rooted desire to serve humanity.

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Aircraft Engines of the World, 1945:
Paul H. Wilkinson. N.Y., Paul H. Wilkinson, 1945. 9¼ in. x 6 in., 352 pp., illus.

Analysis of Drill-Jig Design:
J. I. Karash. N.Y., McGraw-Hill; Toronto, Embassy, 1944. 8½ x 5½ in., 333 pp., illus.

Builders of the Bridge; the Story of John Roebling and His Son:
D. B. Steinman. N.Y., Harcourt, Brace, c1945. 10¼ x 6¾ in., 457 pp., illus.

Canadian Trade Index; Annual Issue of 1945:
Canadian Manufacturers' Association, Toronto, 1945. 10¼ x 6¾ in., 846 pp.

Electrical Drafting; Applied to Circuits and Wiring:
D. Walter Van Gieson. N.Y., McGraw-Hill; Toronto, Embassy, 1945. 8½ x 5¾ in., 140 pp., illus.

Engineering Preview; an Introduction to Engineering Including the Necessary Review of Science and Mathematics:
L. E. Grinter, H. N. Holmes, H. C. Spencer and others. N.Y., Toronto, Macmillan, 1945. 9½ x 7½ in., 619 pp., illus.

Heating, Ventilating, Air Conditioning Guide, 1945:
American Society of Heating and Ventilating Engineers, N.Y., c1945. 9¼ x 6¼ in., 1152 pp. illus.

New City; Principles of Planning:
L. Hilberseimer, with an introduction by Mies van der Rohe. Chicago, Paul Theobald, Montreal, Cambridge Press, 1944. 11¼ x 8¾ in., 196 pp., illus.

Power System Stability; Vol. 1—Steady State Stability:
Selden B. Crary. N.Y., Wiley; Lond., Chapman & Hall, 1945. 8¾ x 5¾ in., 291 pp., illus.

Weights of Steel Products:
N.Y., Montreal, United States Steel Export Company, c1943. 9¼ x 6¾ in., 272 pp.

Workshop Yearbook and Production Engineering Manual; Vol. I:
H. C. Town, Editor. Lond., Paul Elek, c1945. 8¾ x 5¾ in., illus.

PROCEEDINGS, TRANSACTIONS, REPORTS, ETC.

Association of Canadian Fire Marshals; Dominion Fire Prevention Association:
Fire Losses in Canada, 1944. Ottawa, King's Printer, 1945.

Canada, Eighth Census of Canada, 1941:
Vol. 10—Merchandising and Service Establishments—Part 1—Retail Merchandise Trade. Ottawa, King's Printer, 1944.

Massachusetts Institute of Technology:
Catalogue, 1945. Cambridge, Mass., 1945.

Research Council of Alberta:
Annual Report, 1943. Edmonton, King's Printer, 1945.

Royal Society of Edinburgh:
Year Book, 1945. Edinburgh, 1945.

Society of Naval Architects and Marine Engineers:
Transactions, Vol. 52, 1944. N.Y., 1945.
Year Book, 1945, N.Y., 1945.

TECHNICAL BULLETINS, ETC.

Buenos Aires, University. Faculty of Exact Sciences, Physics and Natural Science:
Series B—(Science and Technology) No. 19—Description of the Macrauchenia Patachonica Owen and a Comparison with other Terciary Genus (Theosodon, Scalabrinitherium and Promacrauchenia) by Elsa H. E. F. de Alvarez. Buenos Aires, 1943.

Canada. Department of National Defence. Geographical Section, General Staff:
National Topographic Series, Sheet 41A/9—Nottawasaga, Ont. (Map).

Canadian Affairs:
Vol. 2, No. 9—Business and Post-War Jobs by S. C. Scobell. 1945.

Canadian Standards Association:
C84.2—1945.—CSA Standard Specification for Vinyl Acetal Insulated Magnet Wire. C84.1—1945.—CSA Standard Specification for Enamelled Round Copper Magnet Wire. Ottawa, 1945.

Codes of Practice Committee:
British Standard Code of Practice:—
C.P. (B) 459—Installation of Gas Operated Refrigerators.—CP (B) 462—Gas Cooking Installations for Single Family Dwellings. London, 1945.

Edison Electric Institute—National Electrical Manufacturers Association:
E.E.I.—NEMA Joint Committee on Standards for Distribution Transformers; Second Report (Revised). N.Y., 1945.

Electrochemical Society:
Preprints:—
87-27: Photoconductivity of Zinc-Cadmium Sulfide as Measured with the Cathode-Ray Oscillograph by A. E. Hardy. —87-28: Chemical and Physical Stability of Silicate Phosphors by Herman C. Froelich.—87-29: Welding and Brazing Technics in the Electronic Tube Industry by I. S. Goodman.—87-30: Transient Anode Phenomena by J. H. Bartlett.—87-31: Oxidation-Reduction Potentials Measured with the Dropping Mercury Electrode—Part 5. Anomalous Polarographic Waves in Dilute Solutions of Certain Dyes by Otto H. Muller.—87-32: Theory of Stress Corrosion Cracking of Mild Steel in Nitrate Solutions

by J. T. Waber, H. J. McDonald and B. Longtin.—87-33: Oxidation and Evaporation of Magnesium at Temperatures from 400° to 500° C. by Earl A. Gulbransen.

Highway Research Board:

Wartime Road Problems:—

No. 10: Salvaging Old High Type Flexible Pavements. Washington, 1945.

Research Council of Alberta:

Contributions:—

No. 4: Hot-Water Separation of Alberta Bituminous Sand by K. A. Clark. (Reprinted from Transactions, Canadian Institute of Mining and Metallurgy, 1944).

Toronto, University. Faculty of Applied Science and Engineering. School of Engineering Research:

Technical Memorandum:—

No. 3: Fuel Policy for Canada By E. A. Allcut. (Reprinted from Canadian Journal of Economics and Political Science, Vol. 11, Feb., 1945.)

U.S. Public Health Service:

Public Health Reports, Supplement No. 179: Biological Hygienic, and Medical Properties of Zinc and Zinc Compounds by D. Mark Hegsted, John M. McKibbin and Cecil K. Drinker. Washington, 1945.

PAMPHLETS

Cast Iron in the Chemical and Process Industries:

F. L. La Que. Wash., Gray Iron Founders' Society, N. d.

Development of Chemical Engineering Education in the United States:

Albert B. Newman. N.Y., American Institute of Chemical Engineers, Transactions, Supplement, Vol. 34, No. 3a, 1938.

Distribution of Thunderstorms and the Frequency of Lightning Flashes:

R. Ruedy. Ottawa, National Research Council, 1945. (N.R.C. No. 1282.)

Electrical Engineer; Some Facts Concerning Electrical Engineering as a Career:

N.Y., American Institute of Electrical Engineers, n.d.

Engineer of Today and Tomorrow:

C. F. Hirshfeld. (Reprinted from Mechanical Engineering, August 1934.)

Engineering—A Discipline; the Student and Professional Conduct:

Newark College of Engineering. N.Y. 1938.

Engineer's Duty as a Citizen:

Roy V. Wright. Newark, Newark College of Engineering, 1940.

Guide for Prospectors in Manitoba:

Manitoba, Department of Mines and Natural Resources, 1945.

Inside the Chamber:

Montreal, Canadian Chamber of Commerce, n.d.

Legal Registration of Professional Engineers; a Review of the Problems Faced and Progress Made to Date:

T. Keith Legare. (Reprinted from Civil Engineering, May, 1940.)

Of Tasks Accomplished:

Montreal, Dominion Bridge Company Limited, 1945.

Oil Review, 1944; an Analysis of Alberta Oil Industry:

J. L. Irwin. Alberta, Department of Trade and Industry, n.d.

Organization of Junior Engineers:

Alton C. Chick. (Reprinted from Civil Engineering, Nov. 1938.)

Peace with Progress:

Reports by C. C. Lingard and R. G. Trotter on the Institute of Pacific Relations Conference, Jan., 1945, and the British Commonwealth Relations Conference, Feb., 1945. Toronto, Canadian Institute of International Affairs, 1945.

Personal Appraisal; revised draft, 1945:

N.Y., Engineers' Council for Professional Development, 1945.

Place of the Engineer:

C. R. Young. (Reprinted from Civil Engineering, Dec., 1942.)

Refresher Course in Porcelain Enameling. rev. and abridged from "A Manual of Porcelain Enameling":

Cleveland, Enamelist Publishing Company, 1945.

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.

Saskatchewan—Plans for Progress:

Regina, Bureau of Publications, 1945.

So You Want to Be an Engineer:

(Reprinted from Power, March, 1938). N.Y., Engineers' Council for Professional Development.

Suggestions to Junior Engineers:

N.Y., Engineer's Council for Professional Development, 1936.

Tentative Outline of the New Programme of Studies Proposed for the High Schools of Saskatchewan:

Regina, Department of Education, 1945.

UNRRA; Organization, Aims, Progress:

Wash., United Nations Relief and Rehabilitation Administration, 1944.

What is Engineering Experience?

Charles F. Scott. Columbia, S.C., National Council of State Boards of Engineering Examiners, 1939.

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

AIRCRAFT SERVICING MANUAL

T. C. Preston and G. W. Williamson. Paul Elek (Publishers), London, c1945. 126 pp., illus., 10s. 6d.

This is a guide book to the maintainance or servicing of civil aircraft. The servicing of aircraft is more than a mere trade—it is almost a profession. Aircraft engineers exist to save life and their daily examination of an aircraft, to insure safety in flight, eliminates potential defect or deterioration before things go wrong. To belong to this profession, aircraft engineers must be licensed; and this book is no more than an introduction to that career. Technical detail is included only where inspection instructions would not be clear without it. A very brief selection of books on various aspects of aviation is listed at the end, which will repay study by the candidate for aircraft engineers licenses.

BIBLIOGRAPHY ON SOIL MECHANICS; 1940-1944

R. Ruedy. National Research Council of Canada, Ottawa, 1945. 34 pp., mimeographed, 25c.

A collection of the more important references on the subject pending the preparation of a general review which could only be written in a time of free exchange of information. The bibliography covers the following phases of the subject:—Properties of soils; shearing resistance and conditions of failure in ideal soils; mechanical interaction between solids and water in soils; and elasticity problems in soil mechanics.

CANADIAN TRADE INDEX; Annual Issue of 1945

Canadian Manufacturers' Association, Toronto, 1945. 846 pp., $6.00.

The primary object of this index is to provide an authoritative directory of all products manufactured in Canada and the names of the firms making them. It includes a complete list of Canadian Manufacturers having more than local distribution for their products, irrespective of membership in the Canadian Manufacturers' Association. Coverage is as follows:—An alphabetical directory of over 8,000 Canadian manufacturers with addresses, branches, export representatives, trade marks and brands; a directory of Canadian manufacturers classified according to the products made; a directory of exporters of agricultural produce and allied lines; an export section giving details of Government services; an alphabetical list in French of the headings in the classified section with parallel English; also, in the limited edition, alphabetical lists in Spanish and Portuguese of headings in the classified section with parallel English.

FUNDAMENTALS OF THERMODYNAMICS

Arthur Stanton Adams and George Dewey Hilding. Harper & Bros., N.Y., and Lond., c1945. 289 pp., illus., $3.75.

It is the authors' firm conviction that every beginning student of thermodynamics must have an understanding of the subject as a whole before he can effectively apply its principles in the field of his specialty. The principles of thermodynamics are of such broad fundamental significance to all scientific and engineering endeavour that their study should not be partitioned in terms of their applications at the beginning. In presenting the subject matter, emphasis has been constantly and deliberately placed on a straightforward approach on the solid foundation of the laws of thermodynamics themselves. Some 200 problems are included for the students to solve. The book provides a professional foundation in thermodynamics for the beginning engineering student, and is adaptable to conventional courses.

INTRODUCTION TO ELECTRONICS:

Ralph G. Hudson. Macmillan, Toronto, 1945. 97 pages, illus., $4.00.

This book explains the science of electronics and its modern applications in terms that will be understandable and useful to those with only an elementary knowledge of mathematics and physics. It gives the reader a clear and scientifically exact knowledge of the modern theory of the constitution of matter and the nature of an electric current in a gas, a liquid, a solid, and in a vacuum. It describes and illustrates all of the major uses of electronic tubes and phototubes, the construction of electronic devices and their working principles. One of the leading authorities on electronics, the author has presented the principles of this science with simplicity, clarity, and accuracy.

OF TASKS ACCOMPLISHED; The story of the accomplishments of the Dominion Bridge Company, Limited, and its wholly own subsidiaries in "World War II"

Dominion Bridge Company Limited, Montreal, 1945. 125 pages.

A pictorial review of this Company's war effort.

SCIENCE TODAY AND TOMORROW; 2d series

Waldemar Kaempffert. Viking pr., N.Y.; Macmillan, Toronto, 1945. 279 pages, $3.50.

Science to-day is moving forward at a breathless pace. So fast is the advance of science and technology that already some of the articles in the first series of Science To-day and To-morrow, published in 1939, are out of date and omitted from this new volume. More than half of the material in the second series is new, and records the influence of the war and the increasingly important social effects of science, effects which, as the author points out, are the growing concern of governments as well as of research scientists. The new material includes articles on the new "miracle" drugs, penicillin and the sulfas; synthetic rubber; psychiatry and brain surgery; socialized medicine, vitamins; the search for substitutes; our chemical future; electrons; the possibility of living forever, etc. The author is a master at presenting scientific facts in a vivid non-technical manner.

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.

COMING AGE OF ROCKET POWER

By G. E. Pendray. Harper & Brothers, New York and London, 1945. 244 pp., illus., diagrs., tables, 8¾ x 5¼ in., cloth, $3.50.

The evolution of the rocket principle, from its discovery ages ago to such modern developments as the bazooka and the rocket plane, is described in language that the general reader can understand. The author has long been interested in the possibilities of the rocket and writes with wide knowledge of what has been done, and of future possibilities.

ELEMENTARY STATISTICS

By H. Levy and E. E. Preidel. Ronald Press Co., New York, 1945. 184 pp., diagrs., charts, tables, 7¾ x 5 in., cloth, $2.25.

This book presents the principles of statistics briefly and simply, without requiring more mathematics than elementary algebra. It is based on courses given to students of mathematics, physics and engineering at the Imperial College of Science.

ENGINEERING PREVIEW, an Introduction to Engineering including the necessary review of Science and Mathematics

By L. E. Grinter and others. Macmillan Company, New York, 1945. 581 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.50.

This textbook, designed for high school seniors or college freshmen, treats the background science of engineering—mathematics, chemistry and physics—technical drawing and some of the basic engineering applications of physics. The object is to present in an organized way the background material for later study of any organized field of engineering and thus enable the reader to orient himself and determine whether engineering is the field he should choose.

INDUSTRIAL PURCHASING with Hints on Working with Purchasing Agents

By E. L. Cady. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 256 pp., diagrs., charts, 8½ x 5½ in., cloth, $2.75.

The purchasing function is discussed from all viewpoints from the simple, routine duties of the purchasing agent to the integration of the purchasing department with the other departments of an enterprise. A considerable part of the text is devoted to the thesis that the purchasing agent and the salesman should work together as well as competitively for the best results.

PRACTICAL AND THEORETICAL PHOTOGRAPHY

By J. M. Blair. Pitman Publishing Corp., New York and Chicago, 1945. 243 pp., illus., diagrs., tables, 8 x 5 in., cloth, $2.50.

A sound, simple textbook intended for use in college classes, but also well adapted for individual use.

PRINCIPLES OF FIREARMS

By C. E. Balleisen. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 146 pp., diagrs., charts, tables, 8½ x 5¼ in., cloth, $2.50.

Engineering fundamentals essential for the accurate analysis, design and construction of modern firearms are presented on the basis of the concept that an automatic firearm is a piece of machinery operating in accordance with well-known physical laws. The book is devoted exclusively to small arms and has chapter bibliographies. Gun mounts and exterior ballistics are briefly treated in appendices.

PRINCIPIO TO WHEELING 1715-1945, a Pageant of Iron and Steel

By E. C. May. Harper & Brothers, New York and London, 1945. 335 pp., illus., tables, 8½ x 5¼ in., cloth, $3.00.

This volume traces the evolution of a colonial iron furnace at Principio, Maryland, into the huge blast and open hearth furnaces and steel mills at Wheeling, West Virginia. Two centuries of metallurgical pioneering and industrial expansion are covered. Human interest is provided by the treatment of the personalities behind the events and by the depiction of the life of the times involved.

Principles and Practice of SURVEYING, Vol. 1. Elementary Surveying

By C. B. Breed and G. L. Hosmer. 8th ed. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 717 pp., illus., diagrs., charts, tables, maps, 7½ x 4½ in., cloth, $4.00.

The eighth edition of this well-known text on the elementary surveying has undergone thorough revision. The text on public land surveys has been completely rewritten to conform to present practice, and changes have been made throughout the work in text and problems.

RADIO AMATEUR'S HANDBOOK, 22nd ed., 1945

The American Radio Relay League, Inc., West Hartford, Conn., 512 pp., 200 pp., ads., illus., diagrs., charts, tables, 9½ x 6½ in., paper, $1.00.

The first ten chapters of this comprehensive work constitute a textbook on principles, theory and design considerations. The second group of ten chapters presents examples of practical equipment with essential structural data and instructions for adjustment and use. Most of the revision and additional material in this edition has been dictated by the war emergency. The classified vacuum tube tables remain an invaluable aid, and now have a cross-index by type numbers.

SHRINKAGE and GAS EFFECTS in the CASTING of non-FERROUS METALS and ALLOYS (Association Series No. R.R.A. 661)

By W. A. Baker. British Non-Ferrous Metals Research Association, Euston Street, London, N.W.1, 1944. 44 pp., illus., diagrs., charts, tables, 9¾ x 6 in., paper, 7s. 6d.

The purpose of this report is to provide a survey of the results of various researches on the control of these effects, which are the most obstinate causes of difficulty in castings. Existing knowledge is summarized and practical recommendations are given. There is a bibliography.

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

July 25th, 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 September 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 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

ANDERS—ERNEST, of 4469 St. Catherine St. W., Westmount, Que. Born at St. Helens, Lancs., England, May 27th, 1899. Educ.: classes at Municipal Tech. School, St. Helens during apticeship.; 1914-17, engrg. aptice.; 1917-20, army mechanic, motor transport, R.A.S.C.; 1920-23, fitter & millwright, various firms, Montreal; 1923-26, dftsman, Bell Telephone Co. of Canada; 1926-31, structl. detailer, Dominion Bridge Co.; 1935-37, design & erection, Shawinigan Chemicals Ltd., chemical plant; 1937-38, structl. steel design, Can. Industries Ltd.; 1939, structl. design, Can. Car & Foundry Co.; 1939-40, chemical plant layout & structl. design, Electric Reduction Co.; 1940 to date with Aluminum Co. of Canada, as follows: design of—pumping & dust collection systems, autoclaves & other pressure vessels, rolling mill auxiliary equipt., special machines used in aluminum industry, engrg. reports.

References: G. J. Dodd, A. F. G. Cadenhead, M. E. Hornback, S. R. Banks, A. W. Whitaker, Jr., B. R. Perry.

BELL—PATRICK FRASER, of Port of Spain, Trinidad, B.W.I. Born at Angus, Scotland, July 7th, 1906. Educ.: night classes at Kent Road School and Glasgow Tech. College during ap'ticeship.; 1923-28, five years ap'ticeship. as marine engr. with Harland & Wolffe and Fairfield Shipbuilding Co., Glasgow; 1928-36, marine engr., junior and subsequently second engr., Imperial Oil Co.; 1936-39, field erector on diesel engines with Dominion Engrg. Co., Lachine; 1940, asst. chief engr. on dredge "General Brock", (one season); Feb. 1941, passed exam. for 1st class motor certificate No. 652; at present, genl. supt., Chaguaramas Terminals Ltd., Port of Spain, Trinidad, B.W.I.

References: A. I. Cunningham, A. W. Whitaker, M. P. Weigel, E. Hornback, F. L. Lawton.

BENNETT—WESTON TAFT, of 211 Portland Ave., Town of Mt. Royal, Que. Born at Worcester, Mass., July 31st, 1903. Educ.: B.Sc. (Mech.), Tufts College, Medford, Mass., (accredited E.C.P.D.), 1924; with International Paper Company, as follows: engrg. dftsman., New York, 1928-32, chief dftsman, Gatineau, Que.; 1932-42, plant engr., Gatineau, Que.; 1942-44, asst. chief engr., Montreal, Que.; 1944-45, chief engr., Montreal, Que.

References: F. L. Allen, A. H. Chisholm, C. H. Champion, F. W. Bradshaw, G. F. Layne.

BOYLE—JOHN EDWARD, of 1506 St. Mark St., Montreal, Que. Born at Winnipeg, Man., April 18th, 1910. Educ.; B.A.Sc. (Elect.), Univ. of Toronto, 1932; McGill Univ. extension courses, time & methods engrg., 1945; statistical quality control; 1929-30, (summers), ap'tice. course, Canadian Westinghouse Co., Ltd., Hamilton, Ont.; 1931, (summer), contracting., Morrow & Beatty, Peterborough, Ont.; 1934-37, accounting, A. E. Ames Co., Toronto; 1937-40, sales, installns., mtce. engr., Victor X-Ray Corp., Ltd., London, Eng.; 1940 to date, with Inspection Board of U.K. & Canada, Cherrier, Que., as follows: i/c industrial X-ray inspectn., inspectng. officer of service acceptance of artillery ammunition components, inspectng. officer i/c of fuze divn. c/o Defence Industries, Limited, Cherrier, Que.

References: W. B. Proudfoot, J. S. Campbell, E. A. Ryan, J. L. Bieler, G. H. Kirby.

CHISHOLM—EDWARD OWEN, Captain, R.C.E., of Oakville, Ont. Born at Chilliwack, B.C., Jan. 21st, 1914. Educ.: B.A., Univ. of Toronto, 1939; 1936, asst. to engr., Alkenore Mines Ltd., Buffalo; 1937-38, (summer), asst. field geologist, Ont. Dept. Mines; 1939-41, with McLeod-Cockshutt Gold Mines Ltd., Geraldton, Ont., as asst. to engr. and level foreman; 1942-43, Field Engr., 6th Divn., H.Q., R.C.E.; 1944-45, Tech. Staff Officer, chemical warfare; and at present Tech. Staff Officer, Main Hdqts., 1st Cdn. Army Overseas.

References: E. Arnason.

COSSETTE—PAUL EMILE, of Shawinigan Falls, Que. Born at St. Tite, Que., April 27th, 1916. 1942-44, Shawinigan Tech. Inst., lecturer, night class in mathematics, (arithmetic, trigonometry, algebra and geometry, jr. matric. level); with Can. Industries Ltd., as follows: 1939-40, mtce. clerk; 1940 to date, engrg. dept., drafting, design and supervn. of constrn. on following work: mechanical equipt., piping layouts, ventilation & heating, structl. design.

References: R. Dorion, E. A. Delisle, A. C. Fleischmann, A. S. Holder, E. D. Lavergne.

CONSTANTINI—DONALD HENRY, of 222 Horace St., Norwood, Man. Born at Winnipeg, Man., July 24th, 1910. Educ.: B.Sc., (Civil), Univ. of Manitoba, 1934, R.P.E., Man.; 1932-38, road work, bridges, drafting, genl. engrg. work, Manitoba Good Roads Board; 1933-34, concrete inspectr., i/c constructn. some of the sub-stations, Winnipeg Sewage Disposal Plant; 1939-41, asst. engr., Stevenson's Airfield, Winnipeg, Dept. of National Defence; 1941-44, instructor in English subjects for War Emergency Training Program, and later, Canadian Vocational Training; with Brompton Pulp and Paper Co., as follows: 1944, chief constrn. engr., woods divn., Nipigon, and at present chief field engr., Mill divn., i/c constrn. of mill at Red Rock, Ont.

References: W. B. Korcheski, K. A. Brebner, C. A. Hellstrom, A. E. Macdonald.

DI BENGA— FELIX J., of Joliette, Que. Born at Rapolla, Italy, March 18th, 1883, (cannot trace exactly). Educ.: 2nd year science, McGill, private tuition; 1905-15, mech. designer and asst. plant engr., Montreal Locomotive Works; 1915-17, plant engr., Armstrong-Whitworth; 1917-18, Canadian Vickers; 1919-22, chief dftsman., Mtl. Harbour Comm.; 1922-32, checker, mech. divn., Dominion Bridge; 1935-37, mech. designer, Consumers Glass; 1937-38, layout and checking, John Stadler; 1939-42, checker, dfting. dept., designer, jigs, fixtures, aircraft dept., Can. Car & Foundry, Ft. William & Montreal; 1942-43, chief dftsman, Roger-Majestic, Toronto; 1943, constrn. engr., Defence Industries Ltd.; 1943 to date, chief engr., Joliette Steel Ltd., Joliette, Que.

References: D. Boyd, R. S. Eadie, R. H. Findlay, J. Stadler, P. E. Poitras, P. N. Dobson.

DOBELL—CURZON, of 1405 Peel St., Montreal, Que. Born at Sherbrooke, Que., April 21st, 1909. Educ.: R.M.C., 1927-29; 1930-34, district mgr., Concrete-Masonry Restoration Co. Ltd., Montreal; with Gunite and Waterproof Limited, Montreal, as follows: 1934-39, contract mgr., i/c design, specifications, estimating, etc., 1934-43, genl. mgr., i/c field supervision all work undertaken by company including its operation as Canadian representative for Preload Corp.; 1943 to date, vice-pres., genl. mgr. of the Preload Corp. of Boston, Mass., National Gunite Corporation and Mine Maintenance Corp. of New York, i/c of all work undertaken by the three corporations in the U.S. including design and constrn. of over 500 prestressed concrete tanks, silos, bridges and bldgs., for U.S. Army and Navy Depts., Maritime Commission, E. I. Dupont de Nemours, Inc., etc.

References: R. M. Doull, F. G. Rutley, R. A. Rankin, J. M. Brett, E. P. Muntz, C. B. McRitchie.

GARCIA—ALVIN FRANCIS, of Arvida, Que. Born at Toronto, Ont., July 11th, 1916. Educ.: B.A.Sc. (Mining), Univ. of Toronto, 1940; with Aluminum Co. of Can., Arvida, Que., as follows: 1940-41, genl. tech. work, 1941-42, supvr., pot tining dept., 1942, pot room supvr., 1942-43, asst. to prod. supt., 1943-44, prod. supt., 1944-45, special assignment for prod. supt.

References: F. T. Boutilier, B. E. Bauman, M. G. Saunders, T. A. Carter, A. C. Johnston, H. R. Fee.

KILBORN—ROLAND KENNETH, of Schumacher, Ont. Born at Chengtu, Szechwan, China, Dec. 30th, 1902. Educ.: B.Sc., Queen's Univ., 1927, R.P.E., Ont. and Que.; 1927-28, power developments, Fraser Brace Engrg. Co.; 1928-29, constrn. engr. and dftsman., Falconbridge Nickel Mines; instructor, drafting and surveying, Queen's Univ.; 1930-31, dftsman., Dome Mines Ltd., instru'man., Abitibi Canyon Power Development, Ontario Power Service Corp.; 1932-34, constrn. engr., chief dftsman., Dome Mines Ltd.; 1934-35, chief designing engr., Lamaque Gold Mines Ltd.; 1935-38, constrn. engr., i/c design and constrn., Omega Gold Mines Ltd.; 1938-39, supt. of constrn., Winnipeg Power Development; 1939 to date, mech. supt. i/c mtce., design and constrn., McIntyre-Porcupine Mines Ltd., and Belleterre Quebec Mines Ltd.

References: A. D. Campbell, H. Idsardi, A. Jackson, A. E. MacRae, H. Sutcliffe, D. S. Ellis.

KINGSLAND—KEITH WALTER, of 7604 St. Denis St., Montreal, Que. Born at Montreal, Que., March 4th, 1919. Educ.: Inst. Science and Technology, Toronto, (Prod. Engr.); 1939-41, time study, R.C.A. Victor Co.; 1941-43, time study engr., Sorel Industries Ltd.; 1943 to date, time study and ind. engr., Noorduyn Aviation Ltd.; partner in Kingsland & Marien, industrial consultants.

References: G. L. Wiggs, J. G. Frost, R. Marien, S. H. Clarke, H. Scheunert.

LEITH—BERNARD ARTHUR, of 310 Blackburn Ave., Ottawa, Ont. Born at Sydney, N.S., April 6th, 1921. Educ.: Engrg. Cert., Mt. Allison Univ., 1942; with National Research Council, as follows: 1943-44, lab. asst. at engine laboratory, mech. and structl. design, assisting in reaesrch problems, 1944 to date, i/c drafting room, chief dftsman., engine laboratory, also engaged in minor research problems.

References: D. S. Smith, J. H. Parkin, H. W. McKiel, B. G. Ballard, A. Haltrecht, D. A. MacDonald.

McEACHERN—SINCLAIR, of 5420 Trans-Island Blvd., Montreal, Que. Born at Arden, Man., May 22nd, 1904. Educ.: B.Sc. (Civil), Univ. of Man., 1929; 1927, (summer), technical clerk, Dominion Bridge Co., Winnipeg; 1928, (summer), dftsman, Canadian Pacific Rly., Willingdon, Alta.; 1929-31, dftsman, Western Steel Products, Winnipeg; with Geo. W. Reed Co., Montreal, as follows: 1931-34, dftsman., 1934-42, chief dftsman, asst. plant supt., production of sheet metal products.

References: J. H. Holden, B. R. Perry, R. O. Paulsen, W. J. Armstrong E. P. Fetherstonhaugh, H. C. Nourse.

NARSTED—JOHN, of 146 Easton Ave., Montreal West, Que. Born at Owen Sound, Ont., Dec. 29th, 1890. 1906-10, 4 yrs. ap'ticeship. as machinist and toolmaker at Wm. Kennedy's, Owen Sound; 1910-17, varied machine shop work U.S. & Canada, 3 yrs. foreman; 1917-20, mech. dftsman., Algoma Steel Corp., Soo, Ont.; with the Canada Cement Co. of Can., as follows: 1920-33, mech. engr. and field engr., 1933-35, asst. chief engr., plant design and mtce., 1935-42, chief engr., complete charge all engrg. work for company including plant design, constrn. and mtce., 1942 to date, genl. supt. and chief engr., and supvr. plant production operations.

References: F. B. Kilbourne, H. C. Kennedy, E. G. M. Cape, F. G. Rutley, J. B. Stirling, C. C. Lindsay.

NIXON—IVOR HORNING, of 511 Old Orchard Grove, Toronto 12, Ont. Born at Toronto, Ont., July 7th, 1916. Educ.; B.A., Univ. of Tor., 1939; 1940-41, licensed radio operator, Radio Station CKOC., Hamilton; 1941 to date, quality control engr., responsible for advance planning facilities required to test radar equipment, conducting of actual final approval tests, before delivery to Armed Services, compilation of detailed specifications, design of special test equipment, training and supervision of personnel.

References: B. S. Bjarnason, J. E. Breeze, S. L. Grenzebach, W. E. White, W. E. Phillips.

OLD—FRANK JOHN ARCHBOLD, of 364 Victoria Ave., St. Lambert, Que. Born at Gillingham, Kent, England, July 31st, 1888. Educ.: Articled pupil, civil engrg., 1st class certificate, perspective and design drawing, School of Art and Science, South Kensington, London, 1905; 1904-07, with South Eastern Railway, as follows: extension sidings, London Bridge, constrn., docks for train ferry, Queensboro-Flushing, channel tunnel scheme between England and France; with Director General Ordnance Survey, Southampton, Eng., as follows: 1908-09, ordnance survey in Great Britain, 1909-10, survey examiner in field, Ireland, 1910-11, i/c Tithe Redemption Surveys, Liverpool, valuation surveys, South Wales Coal Fields, topographer, Anglo-Belgian Boundary Commission, Central Africa; 1911-13, on loan to National Defence Dept., Ottawa as topographer; 1914-19, war service with Survey Battalion, 1919, (6 mos.), sr. asst., laying out factory foundations, spur lines to same, with cuts and fill, etc., Sir John Radclifie, civil engrs., Huddersfield, England; 1921-32, returned to Canada, joined Dept. of Interior as cartographer, compilation of standard maps of Canada, (position abolished in 1932); with Dept. of Transport, River St. Lawrence Ship Channel Branch as follows: 1934, engr.; 1937, i/c staff boat, triangulation survey, computing and preparing plans, etc.; 1939-41, when branch took over, dredged channel at Chicoutimi and was sent to investigate conditions, prepared plans, swept channel, etc., supervising constrn. wing dams, determining amount erosion caused to farm property, taking soundings, laying out preliminary work for constrn. of launching ways at Mortons Shipyard, Quebec, i/c buoy laying boat, supervising dredging, etc., and at present engr., (Federal Gov't. classification), New Customs, Bldg., Montreal.

References: J. E. St. Laurent, F. S. Jones, P. Kuhring, C. A. Price, P. E. Walters, J. L. Bizier.

RICHARDS—NORMAN ARCHIBALD, Lieut., R.C.E., of 3 Claxton Blvd., Toronto, Ont. Born at Ottawa, Ont., July 13th, 1916. Educ.: McGill Univ., 1 yr., 1939; (architecture); 1934, instru'man., Geodetic Survey, Canada; 1934-38, layout man, instru'man., with the following: Ross Meaghan Ltd., Piggott Construction Ltd., Hill-Clarke, Francis Ltd., Robt. Gamble Co., and H. Sullivan & Sons, Ltd.; 1938-39, Hill, Clarke, Francis, Ltd.; with A. W. Robertson Ltd., as follows: 1940-41, asst. supt., 1941-43, supt. 1943 to date, with R.C.E., and at present Works Office, No. 7, E. S. & W. Coy., Saint John, N.B.

References: C. D. Carruthers, A. O. Wolff, F. Rousseau., W. B. Akerley J. C. Creaghan

ROSENBERG—DAVID JOHN, of 230 Mt. Royal Ave., East, Montreal, Que. Born at Montreal, Que., April 21st, 1918. Educ.: B.Sc. (Mech.), 1940, Tri-state College (not accredited E.C.P.D.); 1941, (7 mos.), Federal Aircraft; 1941-42, design dftsman, field engr., John Stadler, Montreal; 1942-43, United Shipyards Ltd.; and at present with R.C.A. Victor as follows: chief inspector i/c incoming inspn. dept., supervising staff of inspectors, design gauges, requisition purchase of equipt., plan & schedule dept. work.

References: J. Stadler, H. H. Cantwell, M. Stein.

SMITH—FRANK ERNEST CHARLES, R.C.N.R., of 821 Ridgeway Ave. North, Vancouver, B.C. Born at Edmonton, Alta., April 11th, 1918. Educ.: Diesel engrg., with Hemphill Diesel Schools, Vancouver, B.C., 1937-42, course, machine drawing, advanced shop mathematics, N.S. Tech. Coll.; with R.C.N.R. as follows: 1940-41, oiler, diesel and steam mtce.; 1942-44, oiler, fireman and 4th engr., and at present Motor Mechanic, H.M.C.S. Fort Ramsay, Gaspe, Que.

References:

SMITH—ROBERT W., Lieut., R.C.E., of Gagetown, N.B. Born at Boundary Creek, N.B., Dec. 8th, 1912. Educ.: B.Sc. (Elec.), Univ. of New Brunswick, 1934; 1934-36, telegraph line constrn., Canadian National Telegraph Co., Moncton, N.B.; with Northern Quebec Power Co., Noranda, Que., as follows: 1937-38, power line, and sub-station constrn., 1939-40, sub-station mgr.; 1941-43, asst. chief electrician, Sladen Malartic Gold Mines, Malartic, Que.; 1943, with R.C.E., as follows: 1944, engr. i/c elec. power supply, Canadian Coast Defence Batteries, Dir. of Works and Construction, N.D.H.Q. (Army), Ottawa, and at present Instructor, R.C.E. Wing, O.T.C., Brockville, Ont.

References: A. F. Baird, E. O. Turner, A. G. Grant, W. A. Bickell, H. E. Maple, W. J. Murray, J. Stephens.

USSHER—JAMES WILLIAM, of 139-A Maple Ave., Shawinigan Falls,, Que. Born at Swift Current, Sask., July 13th, 1916. Educ.: B.A.Sc. (Chem)., Univ. of British Columbia, 1940; with Defence Industries as follows: 1940-41, laboratory chemist and supervisor, Nobel, Ont., 1941-42, supervisor T.N.T. area, Nobel, Ont.; 1942 to date, with St. Maurice Chemicals, Shawinigan Falls, Que., as area supervisor i/c production.

References: W. G. Muir, C. R. Morris, V. Jepson, J. S. Whyte, H. K. Wyman, E. T. Buchanan.

WEINREB—MARCELI, of 1518 Mackay St., Montreal, Que. Born at Warsaw, Poland, July 19th, 1898. Educ.: M.Sc. (Mech.), Univ. of Warsaw, 1921, (academic status guaranteed by Assn. Polish Engrs. in Canada); with Ambrozewicz, Warsaw, as follows: 1921-23, moulder in iron foundry, lathe operator, foreman, loconotive erecting shop, 1923, (11 mos.), asst. supt., tech. management, 1924-25, (9 mos.), planned, organized and supervised prod. traction engines, steam rollers, method engrg., estimating, scheduling, supt. diesel engines dept., etc.; 1925-34, Municip. Warsaw, supt. repairs shops, street cars, motor buses; 1934-40, asst. tech. mgr. conversion plant from silverware to shell case prod., Maison Christofle, St. Denis, nr. Paris, France; 1941, (7 mos.), diesel engine dept., drawing office, Dominion Engineering, Lachine, Que.; 1941-42, (13 mos.), marine resident overseer in Marine Industries Shipyards, Sorel, Que., (Lambert, German, Milne, naval architects); 1942-44, engr. for special assignment, Sorel Industries Limited, Sorel, Que.; 1944, Canadian Wooden Aircraft Limited, Toronto, Ont.; 1945, Fairchild Aircraft Limited, Longueuil, Que., as supt. prod. control dept., and at present asst. factory cost engr.

References: L. A. Wright, H. H. German, J. Pawlikowski, H. Ulmann, J. S. Korwin-Gosiewski, W. Czerwinski.

WILLIAMS—WILLIAM ALFRED, of Sarnia, Ont. Born at Sarnia, Ont., Nov. 18th, 1910. Educ.: B.Sc. (Mech.), Univ. of Michigan (accredited E.C.P.D.), 1934, R.P.E., Ont.; 1920-31, (summers), Union Gas Co.; with Imperial Oil Co., as follows: 1932-37, genl. engrg. dept., 1937-42, process engrg. and development work; 1942-45, with R.C.N.V.R., as Lieut. Cdr. (E), honourably discharged, May 31st, 1945; returned to Imperial Oil Limited, Sarnia, Ont., and at present sr. engr., process engrg. and development dept.

References: G. L. Macpherson, C. P. Warkentin, T. Montgomery, F. F. Dyer, G. W. Christie, J. W. MacDonald, M. L. Walker.

WISNICKI—BOLESLAW PAUL, of 210 Westminster Ave., Toronto, Ont. Born at Chrzanow, Poland, July 20th, 1912. Educ.: Mech. & Aero. Engr., Politechnika Lwowska, Lwow, Poland, 1936, (academic status guaranteed by Assn. of Polish Engrs. in Canada); R.P.E., Ont.; 1934-36, designer at Research Institute for gliding and motorless; 1935-36, asst. to prof. of mechanics of flight and aircraft constrn., Institute of Tech., Lwow, Poland; 1937, designer at State Aircraft Factory in Biala, Podlaska, Poland; 1938-39, asst. to chief designer at State Aircraft Factory, Lublin, Poland; 1940, designer and group leader at Societe Olaer, Paris, France; 1941-42, tool designer at Victor Engineering Co. Ltd., Toronto; with Canadian Wooden Aircraft Ltd., Toronto, as follows: 1942-43, chief dftsman., 1943 to date, chief designer.

References: W. Czerwinski, G. A. Mokrzycki, J. Korwin-Gosiewski, J. Pawlikowski, D. Goldwag.

FOR TRANSFER FROM JUNIOR

JOHNSON—JAMES RICHARD, of Ottawa, Ont. Born at Kamloops, B.C., Oct. 20th, 1910. Educ.: B.Eng., McGill Univ., 1934; 1934-37, repairs & mtce., Cons. Paper Corp., Grand'Mere, Que.; 1937-40, asst. chief engr., plant layout, contracts, installn. etc., Dominion Rubber Co.; 1941 to date, officer, Canadian Army as follows: 1941-42, tech., liaison officer, experimental wing, directorate of tank design—reports; 1942-43, tech. staff officer, C.M.H.Q. 1944-45, officer commanding 1 Cdn. Sec. Armoured Fighting Vehicle Tech. Staff Field Force—observation & reports on vehicles in action, exam. enemy equip., emergency field modifications, etc.; at present, Tech. Staff Officer, Direct. Vehicles & Small Arms, N.D.H.Q. (Jr. 1938).

References: F. F. Fulton, O. R. Brumell, R. E. Jamieson, J. T. Wilson, H. G. Thompson, R. Ford.

FOR TRANSFER FROM STUDENT

BLACK—JAMES WILLIAM, of 168 Dufferin Road, Ottawa. Born at Toronto, Ont., Nov. 18th, 1922. Educ.: Passed E.I.C. exams under Schedule B. 1941-42, in control & resch. lab., Sturgeons Ltd., Paint & Varnish; 6 mos., 1942, petroleum lab., Colgate Palmolive Peet Co., 1942 to date, senior lab. asst., petroleum lab., divn. of mech. engrg., National Research Council. (St. 1944).

References: C. J. G. Carroll, J. H. Parkin, C. J. Mackenzie, D. S. Smith, A. Haltrecht.

CAMPBELL—JOHN GRAHAM, of Arvida, Que. Born at Montreal, Que., April 15th, 1917. Educ.: B.Sc., (Met.), Queen's Univ. 1940; 1941-43, metallurgist & test engr., Canadian Locomotive Co. Ltd.; 1943 to date, potroom engineer & supervisor of four Soderberg type potrooms, Aluminum Co. of Canada, Arvida, Que. (St. 1939).

References: A. Jackson, D. S. Ellis, J. G. Campbell, W. F. Campbell, D. D. Reeve, P. Roy.

COOK—CHARLES HENRY, of St. Eustache, Que. Born in England, June 25th, 1917. Educ.: B.Sc., (Elec.), Univ. of Man. 1940. 1940 to date, electrical engineer, Defence Industries Ltd., Montreal, (St. 1940).

References: E. P. Fetherstonhaugh, H. C. Karn, J. R. Auld, A. G. Moore, J. T. Howley.

CUMMING—JOHN WILLIAM, Lieut. (E), R.C.N.V.R., of Sydney, N.S. Born at New Glasgow, N.S., Aug. 24th, 1917. Educ.: B.Eng. (Civil), McGill Univ., 1941; 4 mos., 1941, structl. drawing dept., Alum. Co. of Can., Montreal; 1941-42, supvn. of constrn. Demerara Bauxite Co., Mackenzie, B.G.; with R.C.N.V.R. since 1942 as follows; 6 mos. second engr. officer in

Can. frigate, overseas; at present, mtce. officer i/c repairs and mtce. all Naval shore properties & bldgs., H.M.C.S. Protector, Sydney, N.S. (St. 1941).

References: H. W. McKiel, R. E. Jamieson, G. J. Dodd, T. H. Henry, A. V. Wells, S. Phillips, H. F. Kent, S. G. Naish.

ELDRIDGE—JOHN BRYSON, Major, R.C.E., of Saint John, N.B. Born at Saint John, Aug. 17th, 1915. Educ.: B.Sc. (Elect.), Univ. of N.B., 1936-37 jr. engr. on harbour reconstrn. project, Foundation Co. of Can., Saint John; 1937-40 sales & mtce. English Electric Co. 1937-40; 1940 to date, officer in R.C.E.'S, i/c constrn. bridges, bomb disposal, mine clearance, etc., England, Central Medit. & N.W. Europe Theatre, at present officer commanding "B" Coy., 2 Bn., R.C.E., Overseas. (St. 1936).

References: J. P. Carriere, A. J. E. Smith, W. J. Bright, J. Stephens, A. F. Baird.

GALLI—JOSEPH N., of 4951 Coronet Ave., Montreal, Que. Born in Yugoslavia, Jan. 2nd, 1919. Educ.: B.Sc. (Civil), Univ. of Man., 1942; 1942 to date, with H. E. McKeen & Co., as follows: 1942-43, design & detail of steel reinforced concrete for factory & three steel sheet piling docks; 1943-44, in war plant on prodn. of D.C. machinery; 1944 to date, senior dftsman in engrg. office on mech. design of D.C. motors & generators, supvn. & checking details & compiling prodn. material lists. (St. 1941).

References: O. J. McCulloch, A. E. MacDonald, G. H. Herriot.

HAACKE—EWART M., of Toronto, Ont. Born at Toronto, Ont., Oct. 12th, 1920. Educ.: B.Sc. (Elect.) Queen's Univ., 1942. summer, 1940, jr. elect. engr., Noranda Mines Ltd., summer and term, 1941-42, instructing in basic radio theory for R.C.A.F. at Queen's Univ.; summer, 1942, elect. engr., Bell Tel. Co., Toronto; 1942-Mar. 1945, Radar officer & specialist radio officer R.C.A.F., on east coast of Can., and 3 mos. as officer i/c electronics training at Radar School, Clinton, Ont.; Apr. 1945 to date, assoc. & tech. editor, Electrical News & Engrg., Toronto, being trained for full editor. (St. 1941).

References: D. G. Geiger, A. Jackson, R. A. Low, D. S. Ellis, H. W. Harkness.

HETHERINGTON—WORDSWORTH LLOYD, of Montreal, Que. Born at Vancouver, B.C., May 7th, 1917. Educ.: B.A.Sc. (Elect.), Univ. of B.C., 1939; 1941-42, training course, transformer prodcn. & design, Packard Elect. Co. Ltd., St. Catharines, Ont.; 1942-43, sales & service engr., Packard Electric Co., Montreal; 1943 to date, i/c elect. work engrg., dept. Steel Co. of Canada, Montreal. (St. 1939).

References: E. C. Kirkpatrick, P. E. Poitras, J. N. Finlayson, H. J. MacLeod, A. D. Creer.

HOLLAND—HENRY ALFRED NELSON, of Ville St. Laurent, Que. Born at Montreal, Que., Jan. 11th, 1917. Educ.: B. Eng. (Civil), McGill Univ., 1942; with Bell Telephone Co. of Can. Montreal as follows: 1942-43, engrg. asst., Transmission Dept.' 1943-45 to date, engrg. asst., Toll Cable Dept. (St. 1942).

References: D. J. MacDonald, E. Baty, G. D. Moon, A. D. Nickerson, H. E. McCrudden, G. J. Dodd, R. De L. French.

LOGIE—WILLIAM ALEXANDER, of Montreal, Que. Born at Toronto, Ont., Dec. 31st, 1916. Educ.: B.Sc. (Elect.), Univ. of N.B., 1938; 1938-43, layout, design, testing, constrn. load studies, Elect. Distribution Dept., Montreal Light Heat & Power; 1943 to date, mtce. elect. equip. in substations, short ckt. calculations & tests, checking & puting new equipment in service, Relay Dept., Hydro-Quebec. (St. 1939).

References: W. E. Seely, R. M. Walker, A. Benjamin, S. H. Cunha, R. W. Farmer.

McKERNAN—EARL WESLY, of Isle Maligne, Que. Born at Edmonton, Alta., Oct. 28th, 1914. Educ.: B.Sc. (Elect.), Univ. of Alta., 1941; 1941-42, testing engr., Can. Gen. Elect. Co., Peterboro, Ont.; 1942-43, junior engr., Saguenay Power Co., Isle Maligne; 1943 to date, Superintendent, Saguenay Power Co., Isle Maligne, Que. (St. 1941).

References: J. W. Porteous, H. R. Fee, J. E. Thicke, C. Miller, A. Robert, J. E. Hango.

NUTTER—JAMES RYAN, Lieut. (Sb) (E) R.V.N.C.R., of Truro, N.S. Born at Saint John, N.B., Feb. 16th, 1920. Educ.: B. Eng. (Civil), N.S. Tech. College, 1944; summer 1938, chainman, Dept. of Mines & Res.; summer 1939, rodman, Can. Nat. Rlys.; summer 1940, instruman., Town of Truro, N.S.; summer 1941, instruman., Dept. of Transport; 6 mos. 1943, training 2/Lt., R.C.E., 1943 to date, R.C.N.V.R., at present mtce. officer, Naval Base, Shelburne, N.S. (St. 1942).

References: E. R. Evans, A. S. Donald, H. W. McKiel, S. Ball.

POIRIER—LEO JOSEPH, Of Westmount, Que. Born at Chetticamp, Cape Breton, N.S. Oct. 21st, 1917. Educ.: B.Eng. (Civil), N.S. Tech. Coll. 1944; 1944 to date, detailer & designer, reinforced concrete, Truscon Steel Co., Montreal, Que. (St. 1944).

References: S. Ball, J. W. March, M. L. Baker, A. E. Flynn, F. R. Murray.

QUIST—JACK ERNEST, Elect. Lieut., R.C.N.V.R., of Toronto, Ont. Born at Toronto, Feb. 9th, 1918. Educ.: B.A.Sc. (Elect.), Univ. of Toronto, 1942; 1942-43 (18 mos.), Test Course, Can. Gen. Elect. Co., Peterborough; 1943 to date, R.C.N.V.R., as follows: 4 mos. elect. officer on frigate, i/c elect. equip. at present elect. officer, Directorate Elect. Engrg., N.S.H.Q., Ottawa, preparing drawings, specificns., orders for material for small ships. (St. 1942).

References: C. R. Young, E. A. Allcut, E. G. Cullwick, W. M. Cruthers, G. R. Langley, W. F. Auld.

WALLER—MILFORD JOHN, of Montreal, Que. Born at Glen Cross, Ont., Dec. 20th, 1918. Educ.: B.A.Sc., Univ. of Toronto, 1941; with Northern Electric Co., Montreal, as follows: 1941-44 mfg. engrg. on aircraft radio equip., public address systems, intercomn. equip. & misc. plugs & sockets, 1944 to date, design engrg., Transmitter Engrg. Dept., on high power transmitters. (St. 1940).

References: C. A. Peachey, J. J. H. Miller, S. Sillitoe, E. S. Kelsy, A. D. Ross, A. B. Hunt.

STANDARDIZING BODIES OF THE WORLD TO MEET IN NEW YORK

The Executive Committee on the United Nations Standards Co-ordinating Committee, after an extensive survey of present conditions in the field of international standards and with an eye on the rapidly changing events on the international scene, has come to the conclusion that the time is now ripe for setting up a permanent standards organization. The Executive Committee consists of the British Standards Institution, the Canadian Standards Association and the American Standards Association.

Invitations to attend the meeting have been sent out to the national standardizing bodies comprising the UNSCC:

Standards Association of Australia
Associacao Brasileira de Normas Tecnicas
Canadian Standards Association
Chinese Standards Committee
Association Française de Normalisation
British Standards Institution
New Zealand Standards Institute
South African Standards Institution
American Standards Association.

It is anticipated that representatives from practically all the countries will attend.

Unhampered international trade establishes and cements friendly relations between people. One of the barriers to its fullest development arises from the differing manufacturing practices which exist in the several importing and the exporting countries of the world. To the extent that dimensions and design of equipment, the composition of materials or methods of testing of one country differ from those of another country, hurdles are presented to the free flow of trade.

The capacity of a buying country to employ the products of a selling country is largely determined by the degree to which the seller's products can be integrated into the buyer's economy. International harmony with respect to standards of manufacture, methods of testing and use, are prime means for achieving such integration.

To this end, the national standardizing bodies intend to achieve a collective harmony and agreement with regard to their respective national, industrial and commercial standards and intimately relate these to the economy of the whole world. However, they intend that this shall be accomplished without loss to their own authoritative positions in their respective national communities. The national bodies accordingly are not so much concerned with setting up international standards as they are in bringing their own respective national standards into an alignment with those of the rest of the world.

The simplest and most direct way for arriving at these ends is through an international association which provides the facilities for arranging the necessary technical and administrative conferences and commissions, and which in addition assumes the responsibility for world-wide distribution of information on standards.

Abundant evidence exists that the governments of nations are now minded, collectively, to effect an overall co-ordination in the total world economy. International harmony in industrial and other standards is essential to this end. The future International Association of national standardizing associations, truly reflecting the collective policies of standardizing bodies of the world, will, it is hoped, be able to voice these policies and speak for these associations under the auspices of greatest credibility. The national standardizing bodies intend to implement these policies and achieve the ends in view.

A full programme of the detailed discussions to be undertaken at the meeting will be announced at an early date. In a general way, however, it can be said that the meeting will concern itself with the immediate problem of establishing the closest practical relations between the national standardizing bodies of the countries of the world; with the providing a forum through which these bodies can harmonize their activities internationally and finally the meeting will deal with the major problem of integrating national standards and harmonizing them for the benefit of the total economy of the world.

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

CIVIL

CIVIL ENGINEER is required in eastern Ontario to act as transitman on railway maintenance work for a railway company. Salary is approximately $185. per month with expenses. Apply to Box No. 3036-V.

CIVIL ENGINEER, preferably discharged member of R.C.E., is required for preparation of estimates and general construction work with a small company in Montreal. The salary would be between $200. and $300. a month depending on experience. Apply to Box No. 3038-V.

CIVIL ENGINEER is required by a firm engaged in the manufacture of lumber, to act as instrumentman to check lines and levels for some miles of railroad and highway. Salary for this position will be about $200. a month. Apply to Box No. 3041-V.

EXPERIENCED CONSTRUCTION ENGINEER wanted immediately to take charge of a large townsite building programme in northern Ontario. Give fullest particulars and references in first letter. Apply to Box No. 3043-V.

CIVIL ENGINEER is required by a firm of contractors for work involving soundings, relocation of water mains and general installation of services in a new plant in eastern Ontario. Candidates should be 25 to 30 years old and the starting salary would be in the neighbourhood of $200. a month. Apply to Box No. 3047-V.

CIVIL ENGINEER familiar with estimating residential construction costs and with experience in taking off quantities, etc., is wanted for the construction of complete planned communities in Ontario. This is an excellent opportunity for the right type of individual as there will be a series of such communities to build. Apply to Box No. 3055-V.

ELECTRICAL

ASSISTANT PROFESSOR of electrical engineering who can conduct classes in electricity and magnetism, particularly in the sophomore year, and assist in lab classes in the junior year, is required by a university in eastern Canada to start on the 24th September, 1945. Apply to Box No. 3033-V.

MECHANICAL

SEVERAL MECHANICAL ENGINEERS are required immediately by a firm of contractors for work in connection with the installation of water supply, refrigeration, piping, etc., on a new plant in eastern Ontario. Candidates should be between the ages of 28 and 35 and should have four or five years' industrial experience. Salary would be approximately $250. a month. Apply to Box No. 3035-V.

PROFESSOR of mechanical engineering is required by a university in eastern Canada, with good background of training and experience in this field combined with a high degree of initiative, energy and group value to co-operate closely in courses in electrical, civil engineering and forestry. He will be expected to instruct in machine design, prime movers and materials, supervise lab work in testing materials, etc. Starting 24th September, 1945. Apply to Box No. 3033-V.

TWO MECHANICAL ENGINEERS are required by a firm in Montreal engaged in the manufacture of building materials. Candidates should be between 25 and 30 years old, with general background and preferably ex-service men. The work will involve some structural design, some machine work and general maintenance of buildings and machinery. Starting salary will be between $150. and $225. a month and the location Montreal or Hamilton. Apply to Box No. 3034-V.

MECHANICAL DRAUGHTSMAN, not necessarily a graduate engineer, between 25 and 30 years old and preferably a returned service man, is required by a firm of manufacturers of filters, incinerators, etc. Apply to Box No. 3037-V.

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 three or four years' general experience and about 25 years old, is required for general investigational work, methods improvement, etc., in a large new factory in the Montreal area. Salary will be about $225. a month. Apply to Box No. 3049-V.

SEVERAL MECHANICAL ENGINEERS are required to act as sales engineers for stokers. Some experience in boilers and stoker work desirable but not essential. Candidates should be between 25 and 35 years old and bilingual. Salary will be about $225. a month. Apply to Box No. 3044-V.

TWO ASSISTANT PROFESSORS are required by a university in western Canada, one to specialize in machine design, the other for power plant design. Also a number of demonstrators and instructors, full-time and part-time are needed. Recent graduates will be considered for full-time work or for part-time teaching and part-time post-graduate study. Apply to Box No 3050-V.

MECHANICAL ENGINEER is required to become general superintendent of a machine shop in Montreal. Candidates should be between 30 and 35 years old and should have good shop experience. Apply to Box No. 3051-V.

PRODUCTION AND SERVICE ENGINEER, not necessarily a graduate, is required by a firm of boilermakers and ironfounders in southern Ontario to assist in the development of the manufacture of stoker equipment and later the servicing of it. Good practical experience essential. Apply to Box No. 3052-V.

GRADUATE ENGINEER with about ten years' experience on both structural and mechanical design, with some field experience, preferably about 35 years old, is wanted by a large company in the Montreal area. There are good opportunities offered for the right man. Salary would be designated according to what the applicant had to offer. Apply to Box No. 3054-V.

MISCELLANEOUS

MILL SUPERINTENDENT is required for a paper mill in Three Rivers, preferably but not necessarily a graduate engineer discharged from the armed forces, with native talent and ability to handle miscellaneous jobs and men. Age between 25 and 30. Salary will be $225. to $250. a month depending upon experience. Apply to Box No. 3042-V.

SALES ENGINEER is required for industrial concern in Montreal. Candidates should be graduate engineers with some experience in sales and industrial work, and should have executive ability. Salary will be about $3,000. a year, depending on experience. Apply to Box 3045-V.

SALES ENGINEER, graduate engineer, preferably but not necessarily, in electrical, is required by a firm engaged in the manufacture of all outdoor electrical equipment. Candidates should be about 25 years old, bilingual, and preference will be given to discharged service man. Salary will be between $150. and $225. depending on experience and the location will be in the Toronto area. Apply to Box No. 3046-V.

ARCHITECT OR GOOD ARCHITECTURAL DRAUGHTSMAN wanted by a large firm with head office in Saint John, N.B. This is a permanent position. Apply, stating references, etc., and salary expected to Mr. V. O'Neil, 98 Wright Street, Saint John, N.B.

PLANT ENGINEER with some experience is required by a well-known paper mill in the province of Quebec. Must be able to handle men and deal with labour problems. Apply to Box No. 3057-V.

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

CHEMICAL

CHEMICAL ENGINEER. Young man about 25 years of age, preferably single because of travelling involved, and with experience of a year or more is required to become a sales engineer for an engineering firm in Montreal engaged in installation of acid resistant linings for pulp and paper machinery. The starting salary would be in the neighbourhood of $200. a month. Apply to Box No. 2970-V.

CHEMICAL ENGINEER (or experienced mechanical) is required to act as superintendent of a sulphite mill operated by a Canadian newsprint manufacturer. Some experience in sulphite department of a paper mill is essential. Preference will be given to a veteran. Salary would be between $300 and $375 a month, depending on experience. Apply to Box No. 2985-V.

CHEMICAL ENGINEER with training that would enable him to join the technical section and ability to write good English, is required to act as assistant editor of an engineering publication published in the Montreal area. Some experience in the pulp and paper industry is required and a good personality is important. This position is being held open for a veteran of this war. Apply to Box No. 2999-V.

PAPER MILL FOREMAN is required by a paper company in the St. Maurice Valley to learn paper-making. Preference will be given to an ex-service man and salary will be from $225 to $300 a month. Apply to Box No. 3022-V.

CHEMICAL ENGINEER is required by a Canadian newsprint manufacture for work involving wood preparing, ground wood and sulphite. Previous experience is essential. Preference will be given to ex-service man under 30 years of age and salary will be between $225 and $275 a month. Apply to Box No. 3021-V.

CIVIL

CIVIL ENGINEER, recent graduate, is required by a construction company to start in their filing department and draughting room with the object of becoming thoroughly qualified for work in the field. Headquarters of this firm is in Montreal and the starting salary would be $175. a month. Apply to Box No. 2916-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 is required by a railway company in Montreal to act as an expert on structural steel and concrete as applied to buildings. This position is worth $3000. a year. Apply to Box No. 2951-V.

CIVIL ENGINEERS. Several graduate engineers, either civil or mechanical between the ages of 22 and 30 are required to start as structural steel draughtsmen with the opportunity of becoming structural steel designers and sales engineers. The starting salary varies with experience between $185. and $250. a month. Apply to Box No. 2961-V.

CIVIL ENGINEER, recent graduate is required by a railway company in Montreal for general draughting work in their track department. Apply to Box No. 2973-V.

CIVIL ENGINEER, graduate, with land surveyor's certificate between the ages of 25 and 30 is required to work with a firm of consulting engineers and land surveyors in south-eastern Ontario with eventual prospect of partnership. Starting salary would be $200 a month. Apply to Box No. 2980-V.

CIVIL ENGINEER graduate, about 40 years old, with some experience in structural steel, is required by a bridge company in Ontario as sales engineer and to represent the company to senior officials of other companies. Salary would be approximately $300 a month. Apply to Box No. 2981-V.

CIVIL ENGINEER with fair knowledge of field engineering and surveying is required for general engineering work in connection with the Veterans Land Act. Preference will be given to an ex-service man and salary would be approximately $200 a month. Apply to Box No. 3007-V.

CIVIL ENGINEER is required to act as draughtsman on an immediate project involving work on a transmission line, railway spur, steam power station, etc. This position is with an engineering company in Montreal at a salary to be discussed with the candidate. Apply to Box No. 3009-V.

CIVIL ENGINEER, experienced field engineer under 50 years of age is required for active construction work with a firm in Montreal. Apply to Box No. 3017-V.

ENGINEER-SECRETARY—a young graduate engineer with some experience is required to act as secretary-treasurer of a board of trustees formed for the purpose of the improvement of a district in eastern Ontario, and to supervise the anticipated development of a townsite in the neighbourhood of a recently established mine. Salary will be between $200 and $250 a month Apply to Box No. 3029-V.

ELECTRICAL

GRADUATE ENGINEER, electrical, mechanical or civil with two to three years' experience is required by a firm of specialists in scientific illumination to be trained to act as sales engineer for this firm. The training period will be spent in Toronto at $180. a month. Apply to Box No. 2905-V.

ELECTRICAL SALES ENGINEER for western firm specializing in engineering sales and service of all types of electrical machinery and similar equipment. The position would be permanent and on a salary basis. Applicants should state training, experience, age, nationality and availability. Apply to Box No. 2911-V.

ELECTRICAL ENGINEER, university graduate with general maintenance experience of not less than three years in any branch of sound engineering is required for the post of electrical maintenance supervisor. Salary for this position will be in the neighbourhood of $2400. a year and the location will be in Ottawa. Apply to Box No. 2949-V.

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 between 25 and 35 years old is required by a company in Montreal engaged in the installation of low tension signalling devices, to act as a sales engineer. Personality and appearance are important and some experience is necessary. Preference will be given to a returned service man and salary would be $4000 a year to the right man. Apply to Box No. 3012-V.

ELECTRICAL ENGINEER with some experience between 30 and 40 years of age is required for interesting work on the installation of equipment in a new mill being built by a company engaged in the production of steel. This position will be in southern Ontario and while temporary, might lead to permanent work. Salary would be between $300 and $400 a month depending on experience. Apply to Box No. 3013-V.

ELECTRICAL ENGINEER with some pulp and paper experience is required to act as assistant electrical superintendent for a Canadian newsprint manufacturer. Preference will be given to ex-service man about 30 years old and salary will be $275 to $300 a month. Apply to Box No. 3026-V.

MECHANICAL

MECHANICAL ENGINEER, graduate, preferably with at least 3 years experience as junior mechanical engineer is required to work in the Drummondville plant of a large manufacturing company. Must be bilingual and will be responsible for executing production schedules, maintaining quality standards and maintenance of equipment. Age preferably between 23-27 years. Salary to be discussed with applicant. Apply to Box No. 2756-V.

MECHANICAL ENGINEER, preferably with some experience in the pulp and paper industry is required for draughting and design work with a pulp and paper company in the Lake St. John district at a salary of approximately $300. a month. Apply to Box No. 2941-V.

TWO SENIOR DRAUGHTSMEN with some knowledge of aircraft to work on modifications and repairs of aircraft. This company is situated in the Montreal area. Salary would be in accordance with the qualifications of the applicant. Apply to Box No. 2948-V.

MECHANICAL ENGINEER with tool and die experience and extensive background in intricate work such as small dies, instrument fitting, gauges, etc., and some experience in installation work covering motors, pumps, tanks, etc., is required to act as mechanical design and maintenance supervisor of a motion picture laboratory. This position will be in Ottawa at a salary of approximately $3000. a year. Apply to Box No. 2950-V.

MECHANICAL ENGINEER, young man, bilingual, is required to act as assistant to the chief engineer of a firm engaged in the manufacture of soft drinks. He will be required to do most of the active mechanical engineering of the plant and must be willing to work at times in overalls but be able to represent the company in New York and Ontario, etc. This position is in Montreal at a salary in the neighbourhood of $75. a week. Apply to Box No. 2960-V.

MECHANICAL ENGINEER with some experience in factory operation and routine, including machine shop and bench assembly operations, and if possible, some experience in the manufacture of wire and cable, telephone and switchboard assembly work is required by a firm engaged in this line in south-eastern Ontario. This position would entail establishing production standards through time and motion study, analysis of shop operations, etc. Candidates should be under 35 years of age and can expect a salary of between $175. and $250. a month depending on their experience. Apply to Box *No.* 2967-V.

MECHANICAL ENGINEERS. Several young graduates are required for work involving sales, service and design of mining machinery and pulp and paper equipment. Headquarters of this firm is in Montreal and these positions might be there or in one of their branches scattered across Canada. Salary would be open according to experience. Apply to Box No. 2975-V.

SEVERAL PROJECT ENGINEERS are required by a company engaged in the manufacture of mechanical and electrical equipment in Montreal. Candidates should be graduates in mechanical engineering with some electrical background, with five years experience in product design and under thirty-five years of age. The salary would be in the neighbourhood of $400 a month, with good prospects for advancement to positions such as that of assistant chief engineer and chief draughtsman. Apply to Box No. 2990-V.

MECHANICAL ENGINEERS, over 35 years old, with good plant experience in production or design are required by a firm of industrial consultants in Montreal. Salary would be between $400 and $500 a month. Apply to Box No. 3005-V.

MECHANICAL ENGINEER between 35 and 40 years of age with some paper mill experience is required to act as efficiency engineer in the wood room and wood operations of a paper company in eastern Ontario. Salary is open according to experience. Apply to Box No. 3008-V.

MECHANICAL ENGINEER, graduate, with about three years' experience between 25 and 30 years old, is required for general design work, etc., by a company engaged in the production of structural steel in Montreal at a salary between $225 and $250 a month. Apply to Box No. 3010-V.

MISCELLANEOUS

DESIGNING ENGINEER with pulp and paper mill experience is required for a mill in Newfoundland. This position is worth between $250. and $350. a month depending on qualifications. Apply to Box No. 2937-V

TWO WELDING APPRENTICES, young graduates, are required to work for a firm engaged in specialized welding jobs in the Montreal area. These men will start in the shop for a period of about six months and then proceed through a period in the draughting room into the field as sales engineers with good prospects for promotion for the right men. The salary during the training period will be the equivalent of the current shop rates. Apply to Box No. 2946-V.

ASSISTANT SUPERINTENDENT is required by the street railway department of a city in western Canada. This is a position with excellent post-war prospects for a young transportation engineer between 35 and 40 years of age, with at least five years' experience. Apply to Box No. 2956-V.

BUSINESS MANAGER, not necessarily a graduate, with some experience in handling people, a fair knowledge of construction and some business background, is required by an institution in southern Ontario. Candidates should be over forty years of age and preference will be given to a discharged service man, especially if disabled. Apply to Box No. 2979-V.

STEAM PLANT ENGINEER or stationary engineer is required by a Canadian newsprint manufacturer to learn the pulp and paper business. Apply to Box No. 2986-V.

DRAUGHTSMAN is required by a corporation engaged in the production of synthetic rubber. Candidates must have experience in piping work. This position is in southern Ontario and would be worth between $275 and $300 a month. Apply to Box No. 2987-V.

SALES ENGINEERS are required by a company in Montreal engaged in the manufacture of insulating materials. Candidates must have technical education and preferably some plant operating and sales experience. Conversational knowledge of French desirable. Salary would be $200-$225 a month plus commissions. Apply to Box No. 2993-V.

MINING ENGINEER to give lectures to first two years of geology in a university in New Brunswick. Candidates must be available by September 15, 1945. Apply to Box No. 2996-V.

SEVERAL SALES ENGINEERS are required by a manufacturing company in southern Ontario. Candidates may be graduates or non-graduates in any kind of engineering and would attend a sales engineering school operated by this company for a year. Salary would be $100 a month while learning in addition to any rehabilitation monies coming to them from the Government. Apply to Box No. 3004-V.

SEVERAL RECENT GRADUATES with good character and personality and general engineering background are required by an engineering company in Montreal to start on draughting or field work. Apply to Box No. 3009-V.

SEVERAL ENGINEERING DRAUGHTSMEN, preferably ex-service men, 30 years or younger, are required by a Canadian newsprint manufacturer. Salary would be between $160 and $250 a month depending on experience. Apply to Box No. 3023-V.

Situations Wanted

SALES ENGINEER, Mechanical engineer, M.E.I.C., P.E.Q., age 39, experienced in general machinery, boilers, pumps, mechanical equipment of buildings, etc., some sales experience, desires position as sales engineer with headquarters in Montreal, with progressive firm manufacturing or handling varied range of equipment. Apply to Box No. 270-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., R.P.E., in B.C., 40 years of age, married, 8 years' experience as superintendent and field engineer on construction including skeleton steel, reinforced concrete and timber structures. Some experience in taking off quantities and in design of water distribution systems. Eleven years' experience in supervisory and managerial positions in manufacturing. At present engaged as factory manager in the manufacture of a line of engineering products. Seeking a permanent position in a well-established organization where there will be greater scope for my abilities. Will be available on reasonable notice, under W.B.T.P. regulations. Applyto Box No. 880-W.

GRADUATE PROFESSIONAL ENGINEER proposing to establish consulting engineering practice would like to confer with engineer interested in similar proposition. Must have experience in the various mechanical trades of the building industry. Apply to Box No. 2099-W.

MECHANICAL ENGINEER, M.E.I.C., age 27, B.Sc. and B.E. (Mech.). Experienced as works engineer of large manufacturing plant. For the last two years with the R.C.E.M.E., in charge of installation, maintenance, inspection and administration of the mechanical, electrical and optical fire control equipment of entire Canadian East coast. Not available until released from Army but wishes to make contacts for post-war position. Apply to Box No. 2307-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., with 16 years experience in Canada and abroad in tool machines, tool design, general machine design, shop and industrial engineering, and as chief industrial engineer in plant employing 6000 men. At present chief engineer with large aircraft manufacturing company in Montreal. Successful organizer, age 40, available shortly. Apply to Box No. 2502-W.

CIVIL AND MECHANICAL ENGINEER, M.E.I.C., R.P.E. (Que.), B. A. Sc. (honours) Toronto, desires administrative position with responsibility in an expanding and progressive industry. Applicant has ten years engineering and supervisory experience, four years in design, estimating, fabricating and erection of steel plate work, and six years in plant layout and design, mechanical equipment design and installation, and administration of engineering, maintenance and construction departments of a large plant. Excellent references. Available under W.B.T.P. regulations PC 2496. Apply to Box No. 2503-W.

CIVIL ENGINEER, Jr.E.I.C., age 31, married, temporarily employed by Naval Service; four years general experience including road construction, draughting and design, purchasing, six years in government service, past four as resident engineer on Naval Base construction; desires position leading to purchasing work with large industrial or contracting company; location immaterial. Available on one month's notice. Apply to Box No. 2504-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., with experience in design and manufacturing of pulp and paper machinery, for the past thirteen years superintendent in charge of maintenance and construction with large newsprint mills, is open for new engagement in position of responsibility. Immediately available under the regulations of the W.B.T.P. Apply to Box No. 2505-W.

GRADUATE CIVIL ENGINEER with 10 years' experience in surveying, estimating, heavy construction, municipal work, water supply systems, etc. Would prefer small contracting concern. Apply to Box No. 2506-W.

EXECUTIVE ENGINEER available. Graduate in mining, M.E.I.C., age 36, married. With experience in engineering sales work, road and paving construction, miscellaneous engineering, building construction, plant engineering; responsible for steam and water plants, water and sewage works, electrical power distribution, maintenance of plant buildings and miscellaneous process equipment. Experience in cost accounting, designing and estimating. Administrative experience as assistant manager of munitions plant. Capable of handling men. Apply to Box No. 2508-W.

GRADUATE CIVIL ENGINEER, age 32, presently serving in R.C.A.F., wishes to establish contacts with a view to rehabilitation in the near future. Ten years' experience in engineering work, five of which were in an executive capacity. Interested in position with general contractors or industrial firm. Would prefer position with British Columbia company or as representative in B.C. for eastern concern. Apply to Box No. 2515-W.

CIVIL ENGINEER, Jr.E.I.C., age 25, B.Sc. Alberta, 3 years on highway location and construction, 2 years building construction and maintenance; desires contacts in construction or industrial field for employment in near future. At present engineer works officer, R.C.E., Location immaterial. Apply to Box No. 2521-W.

UNITED NATIONS RELIEF AND REHABILITATION ADMINISTRATION

The conditions in China now are such that a number of positions for engineers with UNRRA must be filled immediately. Recruiting is also under way for candidates for other vacancies for which appointments must be made by the later dates shown below.

Wide requirements are expected to arise for various levels of administrative men in railway, utility, marine, communications, industry, and a number of very small industries adaptable to China. It will of course be necessary to fill the senior positions with men of very wide experience in the particular line, but for many of these vacancies responsible administrative and practical field experience in the armed forces would be a desirable background. In the belief that some interest in this sort of work exists among men in this category, this notice is being sent to engineers still in the armed forces.

In view of the urgency of the situation and in order to save time and duplication of work, applications should be addressed to—

C. P. Holmes, Esq.,
Civil Service Commission,
Room 204,
202 Queen Street, Ottawa, Ont.

A limited number of application forms is being distributed, but a letter, containing complete information on personal particulars, educational attainments, and professional experience, addressed as above, will suffice.

The positions for which recruiting is now being carried on are as follows:

I—TO BE FILLED IMMEDIATELY:

1) **Plans and Programming Officer—Grade 14**

Qualifications: The Plans and Programming Officer should have a thorough knowledge of planning, programming, scheduling and reporting progress in a large action agency and a good knowledge of the theory and practice of program planning and scheduling; a high degree of intelligence, initiative, judgment and cooperativeness and good physical condition.

2) **Chief Inspection Officer—Grade 12**

Qualifications: The Chief Inspection Officer should have a thorough knowledge of the theory and practice of administering an inspectional service, good analytical ability; a high degree of integrity and good judgment and good physical condition. A good knowledge of China is very desirable.

3) **Work Relief Projects Officer—Grade 13**

Qualifications: The Works Relief Projects Officer should have a thorough knowledge of the methods of planning, programming and administering emergency work relief programs; familiarity with engineering and construction work; a good knowledge of labor and employment management; a good knowledge of the policies and problems governing national public work relief programs; skill in organization; intelligence, initiative, resourcefulness, tact, judgment and good physical condition.

4) **Chief Industrial Rehabilitation Officer—Grade 13**

Qualifications: The Chief Industrial Rehabilitation Officer should have a thorough knowledge of a wide range of industrial repair, rehabilitation and production methods and of the supply problems in such industries; a good knowledge of small industry and its development; very good administrative ability; intelligence, resourcefulness, integrity, tact and judgment and very good physical condition.

5) **Transportation Officer (Depot and Traffic) Grade 12**

Qualifications: The Transportation Officer (Depot & Traffic) should have a thorough knowledge of warehousing and traffic management; ability to coordinate and to develop organizational and operational plans practicable with existing facilities and equipment; intelligence; resourcefulness, initiative and tact and good physical condition.

6) **Transportation Officer (Highways) Grade 12**

Qualifications: The Transportation Officer (Highways) should have a thorough knowledge of highway transportation including scheduling, operations; and maintenance administrative ability; analytical ability; resourcefulness, initiative, tact and judgment and very good physical condition.

7) **Industrial Rehabilitation Officer (Heavy Industry) Grade 12**

Qualifications: The Industrial Rehabilitation Officer (Heavy Industry) should have a broad familiarity with the various heavy industries involved in China's rehabilitation program; familiarity with heavy industrial equipment, machinery and supplies; good engineering and planning ability; resourcefulness, flexibility, and intelligence and tact and good physical condition.

8) **Industrial Rehabilitation Field Officer—Grade 11**

II—TO BE FILLED BY 1ST OCTOBER, 1945

1) **Water Conservancy Engineer—Grade 13**

Qualifications: The Water Conservancy Engineer should have a thorough knowledge of planning methods for conservancy and multiple purpose projects; broad ability in hydroelectric development and engineering; ability to relate such planning to a total program for improving national economy; ability in planning river improvement and control including flood prevention, navigation, irrigation and water power aspects; it would be desirable that he have an understanding of water conservancy problems in China, although this is not essential; he should possess a high degree of intelligence, tact, diplomacy, and good judgment and very good physical condition.

2) **Telephone Line Consulting Engineer—Grade 11**

Qualifications: The Telephone Line Engineer should have a thorough knowledge of the practices and problems in constructing and maintaining long distance telephone lines; ability to adapt such practices to a situation where facilities may be limited; ability to plan and set up training programs; good intelligence, tact, resourcefulness and judgment and very good physical condition.

3) **Shipping Operations Advisor—Grade 11**

Qualifications: The Shipping Operations Advisor should have a thorough knowledge of large-scale ocean and river shipping operations and management; ability to improve methods and efficiency and devise methods applicable to a new situation; a high degree of intelligence, initiative, inventiveness, resourcefulness, judgment and tact and very good physical condition.

4) **Highway Engineer—Grade 10**

Qualifications: A Highway Engineer should have a thorough, up-to-date knowledge of highway planning, design, construction and maintenance; ability to adapt such methods to a situation where facilities may be limited; good training ability, good intelligence, tact, resourcefulness, judgment; and very good physical condition.

5) **Railway Organization Consultant—Grade 13**

Qualifications: The Railway Organization Consultant should have a thorough knowledge of the methods of organizing railways nationally, in networks, regionally and divisionally, as well as the best management and operational systems to use in such organizations; a thorough knowledge of the principles and practices of individual railway organization, management and operation; good analytical and planning ability, a high degree of intelligence, imagination, resourcefulness, adaptability and judgment and good physical condition.

6) **Railway Repair Works Consultant—Grade 13**

Qualifications: The Railway Repair Works Consultant should have a thorough knowledge of the layout, management and operation of large locomotive and car repair works; ability to plan layouts, and management and operational methods best suited to a new situation; good analytical ability; a high degree of intelligence, imagination, resourcefulness, initiative, tact, and judgment and good physical condition.

III—TO BE FILLED BY 15TH NOVEMBER, 1945

1) **Carrier System Engineer—Grade 11**

Qualifications: The Carrier System Engineer should have a thorough knowledge of telephone line equipment, including terminal and repeater equipment for type J-12-channel carrier systems; ability to develop methods where facilities may be limited; good ability in personnel framing; good intelligence, tact, resourcefulness and judgment; and very good physical condition.

2) **Chief Telephone Lineman—Grade 10**

Qualifications: The Telephone Line Engineer should have a thorough practical knowledge of modern methods in the maintenance, repair and construction of long distance telephone lines; both open wire and cable; ability to adapt such methods to a situation where facilities may be limited; training ability; good mechanical ability, tact, friendliness, resourcefulness and judgment; and excellent physical condition.

3) **Highway Mechanical Engineer—Grade 10**

Qualifications: A Highway Mechanical Engineer should have considerable intensive and responsible experience in supervising the operation, repair and maintenance of all types of road machinery; ability to adapt methods previously used to the machinery involved in the highway rehabilitation program in China; ability to meet situations where facilities may be limited; good training ability; good intelligence; adaptability, resourcefulness, tact, and judgment; and very good physical condition.

4) **A.P.B. Signal Engineer—Grade 11**

Qualifications: An A.P.B. Signal Engineer should have a thorough knowledge of AC and DC tract circuits, A.P.B. circuits, semaphore and searchlight signals, traffic locking and power supply equipment; ability to adapt to a situation where facilities may be limited; good intelligence, tact, resourcefulness and judgment and very good physical condition.

5) **Bridge Shop Consulting Engineer—Grade 12**

Qualifications: The Bridge Shop Consulting Engineer should have a thorough knowledge of railway bridge fabrication plan installations, shops and mold lofts, equipment and operations, and modern engineering and shop practices; a good knowledge of modern engineering shop and design practice; a good knowledge of railway bridge design practices, ability to devise plans to meet situations where facilities may be limited; a high degree of intelligence, tact, initiative, resourcefulness and judgment and very good physical condition.

IV—TO BE FILLED BY 31ST DECEMBER, 1945

1) **Yellow River Conservancy Advisor—Grade 12**

Qualifications: The Yellow River Conservancy Advisor should have a thorough knowledge of the methods of regulating alluvial rivers of heavy silt flow and of the techniques of planning for multiple purpose projects including flood control, navigation, irrigation and water power; a good practical knowledge of civil and hydraulic engineering; a high degree of intelligence, tact and good judgment; and good physical condition.

2) **Welding Instructor—Grade 10**

Qualifications: A Welding Instructor should have a thorough practical knowledge of modern gas and electric welding and cutting practices, techniques and materials and should be skilled in them; he should have mechanical and training ability; good intelligence; tact, friendliness, adaptability; resourcefulness and judgment, and should be in excellent physical condition.

3) **Telephone Transmission Consulting Engineer—Grade 12**

Qualifications: The Telephone Transmission Consulting Engineer should have a thorough knowledge of the methods and problems in laying out and designing a long distance telephone network; including transposition in long distance lines; ability to adapt to a situation where facilities are limited; ability to plan and set up training programs; a high degree of intelligence, tact, resourcefulness and judgment and good physical condition.

4) **Cable-Splicing Instructor—Grade 10**

Qualifications: The Cable-Splicing Instructor should have a thorough knowledge of modern methods of splicing telephone cables and skill in such methods; ability to adapt to situations where tools and equipment may be limited; training ability; good mechanical ability, tact, friendliness, resourcefulness and judgment; and excellent physical condition.

5) **Radio Consulting Engineer—Grade 12**

Qualifications: The Radio Engineer should have thorough knowledge of the equipment and operating practices for modern radio communications; ability to improvise where facilities are limited; good ability in training and training programs; good intelligence, tact, resourcefulness, judgment and mechanical ability, and very good physical condition.

Salary for the positions listed is indicated by the grade, and will vary from a minimum of about $4,500 per annum for Grade 10 up to a maximum of about $8,000 for Grade 13. Grade 14 is worth more.

In addition, an allowance of $1.50 per diem will be paid to men who have dependents to support at home. Also complete maintenance in the field is provided, and a Provident Fund, into which each employee pays 5 per cent of his salary, and UNRRA pays 7½ per cent, will be paid to employees on separation.

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

Horace H. Rackham Memorial Building, Detroit, Mich., where is to be held on October 5th the joint meeting of the Detroit Section of the American Society of Mechanical Engineers and the Border Cities Branch of the Institute.

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WATER-WHEEL GENERATORS

Modern Construction Practice in the United States

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During the war period the purchase of both water-wheel and steam-driven generators for electrical utility power production has been very much curtailed in the United States of America. Most of the generating units which were on order at the time our nation became a war participant have been completed and are now in service; some have been held for later manufacture when critical materials are available; and a few others have been cancelled.

Recent Large Installations

It might be of interest to review the present status of some of the more prominent water power projects in the States. In the Columbia River basin, the Bonneville and the Grand Coulee dams are finished. At Grand Coulee there are six 108,000 kva. 120 rpm. and two 16,500 kva. water-wheel generators of Westinghouse manufacture in service. The manufacture of three additional 108,000 kva. duplicate units by Westinghouse has been held for post-war manufacture. Two 75,000 kva. units, which were built by the General Electric Company and were being held in storage pending the completion of the Shasta Dam power plant, later were installed temporarily at Grand Coulee. The turbines driving the two 75,000 kva. units have their intake tubes so located that power plant space required by these two units at Grand Coulee is the same as that provided for three 108,000 kva. units. It is expected that these two units will be removed at some future date and replaced with three 108,000 kva. units and thus make available 174,000 kva. additional capacity. The Bonneville power plant is complete and has two 48,000 kva. and eight 60,000 kva. units of General Electric manufacture in service. Electric power from these two projects contributed greatly in the production of aluminum, and in the shipbuilding industry in the northwestern part of the United States.

In the Colorado River basin, the Boulder Dam and Parker Dam projects are complete. At Boulder Dam there are now installed six 82,500 kva. units of General Electric manufacture, six 82,500 kva. units of Westinghouse manufacture, and one 40,000 kva. unit of Allis-Chalmers manufacture. Space is still available for three additional 82,500 kva. and one 40,000 kva. units. All of these units were originally designed to be suitable for operation at 50 or 60-cycle frequency. Two of the 82,500 kva. units are now operated at 50 cycles and the remaining ones deliver 60-cycle power. The Parker Dam power plant is complete with four 30,000 kva. water-wheel generators of Westinghouse manufacture. These two water power plants have likewise played a vital part in supplying power for the light metals, aircraft, and shipbuilding industries in the southwestern part of the United States.

In the Tennessee River basin, the major hydro-developments under the jurisdiction of the Tennessee Valley Authority are nearing completion with the construction of the Kentucky dam. T.V.A. has, under its jurisdiction, water power plants with a total capacity of 2,125,000 kva. and a large standby steam generating station. This Authority has become one of the largest power producing units in the United States.

The Shasta River dam, in upper California, has been completed and two 75,000 kva. water-wheel generators have been installed in the power plant. Although most of the water power projects have been developed by governmental agencies, some installations by private enterprise have been made. Four 40,000 kva., 300 rpm. water-wheel units have recently been placed in service by the Pacific Gas and Electric Company at their new Pit River station.

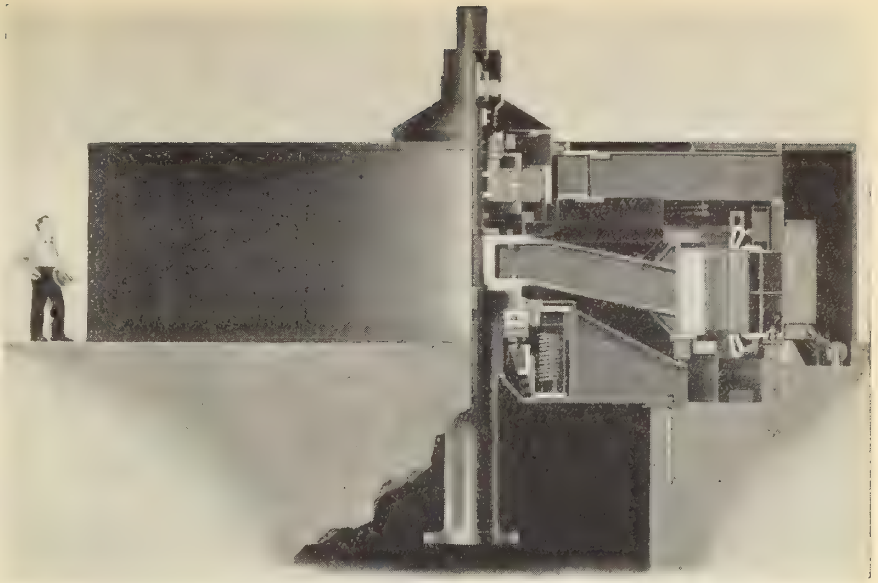
Post War Projects

At the present time, much consideration is being given to the development of water power resources in the U.S.A. for post war action by both private enterprise and government agencies. There are, under active negotiation at the present time, new water-wheel generator projects for more than 1,500,000 kva. total capacity, involving about 52 units with a total value of $16,700,000. Likewise, negotiations for foreign projects amount to approximately 550,000 kva., involving about 63 units with a total value of $5,120,000. There is political and economic consideration being given by the present administration to the development of the water power resources of several additional river drainage basins. This includes the St. Lawrence River project which is now being given engineering study and which is of mutual interest to the United States and Canada. From the above it is fairly apparent that there will be an appreciable amount of orders placed for water-wheel generators during the post war period.

Design Features of Large Generators

Water power sites are usually at relatively long distances from the centres of distribution and ultimate utilization of the power. This means that such machines must not only produce the electric power but must operate with sufficient stability when transmitting it over long lines to the consuming centres. The transmission line introduces reactance, capacity and resistance coefficients which are not present to the same extent in the electric distribution system in which power is generated at or near the load centres. This condition necessitates that this type of generator be less responsive to load changes and system disturbances which affect voltage and power output. In a general way this means that the transient reactance should be low, and the short-circuit ratio relatively high. The downward trend in transient reactance and the upward trend in short-circuit ratio result in a larger upward trend in physical size and a resultant increase in cost of the unit.

From the mechanical standpoint, water-wheel generators differ from other generators in that they must be designed and built to withstand the maximum runaway speed which the turbine will attain under full head conditions with the intake gates wide open. The need for this requirement is due to the fact that the load may be suddenly removed by the opening of the main breaker with the gates in the full open position. In order to reduce the rate of rise in speed, adequate "flywheel effect" or WR^2 must be built into the rotating parts. Since the generator rotor is normally of much greater weight and physical dimensions than the runner of the turbine, it is more economical and is standard practice to incorporate the needed WR^2 in the generator rotor.



A cutaway section view of an umbrella or single-guide bearing type water-wheel generator.

In meeting this high overspeed requirement it is necessary to use materials in the rotor which have high physical properties and are free of faults or defects. The physical dimensions of the medium and larger rated machines are such that neither single piece nor multiple piece castings or forgings can be used for the rotor rim and still result in an economical and reliable construction. The desired rim construction has been obtained by building it as a complete circle from segmental pieces of thin punched laminations, or machined rolled or forged steel plate. The desired physical strength of the rim is obtained by overlapping the segments, and using tight fitting through bolts which clamp the rim punchings together under high unit contact pressures.

The dimensions of large capacity water-wheel generators are such that the unit must be shipped in more or less completely assembled separate parts or built as a unit at the customer's plant. In the case of Westinghouse units, the rotating element consists of a cast or fabricated steel spider; laminated rim, and field pole and winding assemblies. The spider can be, and is in most cases, shipped as a one piece finished part. In some instances, it is necessary to have a few of the spider arms with removable end parts in order to meet shipping limitations. The laminated rim is built around and finally shrunk onto the spider, and the poles and coils are assembled in the conventional manner. It is thus inevitable that much of the assembly work of the rotor must be done at the user's plant.

In the case of the stator, the core can be made in two or more assembled and partially wound sections and shipped to the destination for final assembly, or all core building and winding operations can be performed at the destination. The mechanical design and construction requirements, for satisfactory performance of water-wheel generators with segmental stator cores and frames, have been reached from experience obtained in many years actual operation. It is believed, and several years experience indicates, that a satisfactory segmental construction is now being used. It may be necessary, at relatively long intervals (10 years), to increase the pressure at the core splits by removing spacer shims at the frame splits and increasing the tension on the frame split bolts.

The alternate proposition of building the core at the user's plant, as a complete circle, probably gives a product which has the maximum mechanical stability and the least maintenance time and expense, but the initial cost will be appreciably greater. It is questionable whether the advantages obtained from this construction and building procedure will justify the increased investment costs by the purchaser. Under present conditions, it is in the best interests of both manufacturer and purchaser for all possible manufacturing and assembly operations to be done at the manufacturer's plant.

It has become standard practice with all water-wheel generators to recirculate the cooling air and to have surface type finned tube air coolers to dissipate the losses. The conventional arrangement is for several cooler sections to be located symmetrically around the outer periphery of the unit and enclosed in a relatively light metal structure. This results in a unit of simple construction, smooth lines, with symmetrical parts, and pleasing in external appearance.

It has become almost uniform practice in the U.S.A. to build water-wheel generators with full Class B insulation for both the stator and rotor windings, but to have 60 deg. C. temperature rise guarantees for both windings. This results in units which have a long life expectancy under normal operating conditions and ample reserve capability for emergency overload conditions. The present efficiency levels are about the maximum that can be obtained by using the intermediate-loss grade of silicon steel for the stator core, non-magnetic material for structural parts such as ventilation spacers, end fingers and coil supports, and an efficient equivalent transposition of the stator conductors. Some slight increase in efficiency can be obtained by reducing the stray load losses through the use of more costly structural materials and by the use of additional design features and refinements in the machine proportions.

Modern water-wheel driven a-c generators may be divided, from the standpoint of construction, into two classes: namely—the single and the two-guide bearing class.

Single-Guide Bearing Type

The first, which is commonly known as the umbrella type, has the thrust bearing located beneath the rotor spider, and the guide bearing, in the case of Westinghouse units, is built as an integral part of the thrust bearing assembly. The guide bearing in this case is invariably of the pivoted shoe type construction. The single guide bearing umbrella type unit has outstanding advantages to the purchaser and user:

(1) Single oil reservoir for the combination guide and thrust bearing assembly with no recirculation of the oil.
(2) Minimum head room required for assembly and maintenance of the unit.
(3) The generator spider can be removed and the unit given a complete maintenance overhaul without breaking the main coupling or disturbing the bearings and the mechanical alignment of the unit.
(4) Simple lubricating system—with the minimum number of bearings to supply and maintain.

Generally speaking, the single guide bearing type of unit is suited for low speed applications where rotor diameters are large and the core lengths are relatively small. It is advisable, from the mechanical standpoint, to have the distance from the horizontal central plane of the rotor core to the centreline of the guide bearing rubbing surface as small as possible.

The stability of the rotor depends mainly on the relation between the magnetic pull and the stabilizing effect of the thrust bearing and of the shaft. Usually the thrust bearing has a larger stabilizing effect than the shaft. With the conventional thrust bearing having the shoes supported on jack screws, a large side load can be applied at the centre of the rotor before the thrust bearing runner will begin to lift away from the thrust bearing shoes.

Neither operating experience nor analytical studies indicate that the definite limitation has been reached for the ratio of rotor diameter to length, or for the minimum distance from the bearing surface to the central plane of the rotor core. These limits are being extended as more experience is available and thus the existing wide field of application for this type of unit is becoming still wider. In modern water-wheel generators, the trend is definitely toward the single bearing construction where this type of machine is applicable.

Two-Guide Bearing Type

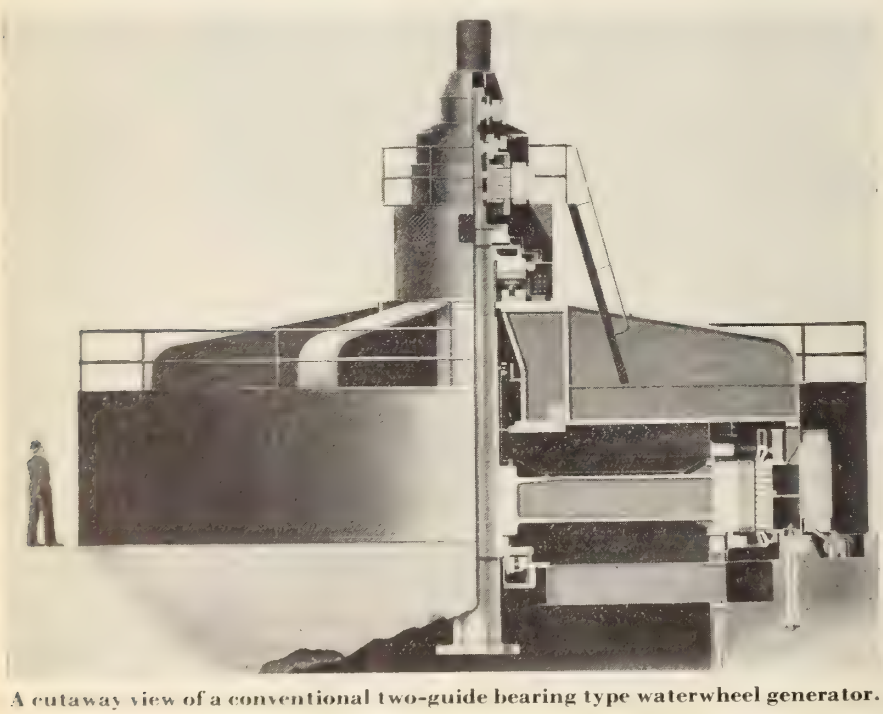
The conventional two-guide bearing type of water-wheel generator has the thrust bearing located above the main generator parts. In the earlier units the guide bearings were of the sleeve type and were lubricated and cooled by circulating the oil. It has recently been our standard practice to use the pivoted adjustable shoe type guide bearing operating in a bath of oil for this application, thus eliminating the circulation of the oil. In most cases, the upper guide bearing is built combined with the thrust bearing assembly to simplify both construction and operation. The two-guide bearing construction is applicable and needed, for large, high speed units which have relatively small rotor diameters and long axial lengths.

Stator Windings

The stator windings of vertical water-wheel generators as a rule consist of form wound multi-turn continuous coils. The conductors are stranded both depth- and width-wise to reduce eddy current losses. With the use of multiple conductors and multiple parallel circuits there is usually no need for transposition of the strands of the individual conductors. The strands of the conductor which formerly were insulated with either asbestos or mica tape are now insulated with glass fibre. Mica tape is used for the conductor and coil insulation. An outside layer of glass tape is used on the completely insulated coil to provide a protective armour and to form the base for the semi-conducting material which is applied to the external surface of the coil for corona protection.

Glass insulation in its different forms is finding an increasingly large use on all of the larger high voltage machines. In the form of cord, it is used to lash the coil ends to the bracing supports and in the form of cord or tape it is used to support spacing blocks. As is becomes more available in the form of special kinds of cloth, it is expected to eventually form the base for mica tape, which will make available full Class B insulation for the stator winding.

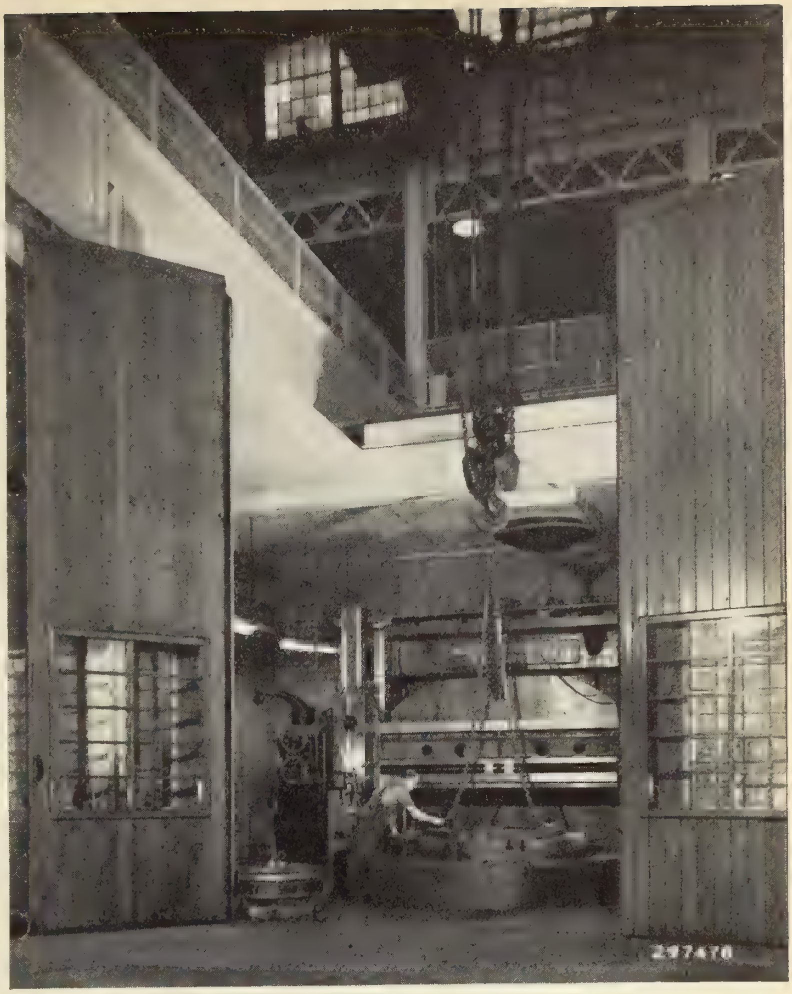
The elimination of corona from the entire stator winding and wiring connectors of high voltage rotating machines at operating voltages has been desired by both manufacturer and user for many years. Since 1929, successful elimination of corona on the straight or buried part of the coil has been accomplished by applying a semi-conducting material known commercially as Aquadag to the outer surface of the coil. This high resistance conducting material in contact with



A cutaway view of a conventional two-guide bearing type waterwheel generator.

the stator iron brings the potential of the coil surface to ground potential and thus completely eliminates corona.

With the conventional two-coil-side-per-slot type of windings, two adjacent coils, or two coils within the same slot, may differ in potential by full line voltage. The amount of corona existing in the end winding zone depends on the distance between coil surfaces, condition of the surface with respect to smoothness, and the type of bracing used. The corona situation can be appreciably improved by obtaining smooth surfaces free of projections or sharp corners, and avoid small spacing between coil sides which have high potential differences. Generally speaking, such coils should be sufficiently insulated so that the surfaces can be brought firmly together, or the spacing made great enough to prevent appreciable corona. Further reduction of corona can be accomplished only by applying a semi-conducting material to the surfaces of the parts in question. The end winding problem is essentially different from that of the part in the slots due to the fact that the electrical charges on the end turns must be conducted over the surface of the coil to ground (stator iron). The surface coating of each section of the coil must permit the total charge on the coil beyond this section to flow across the surface without overheating. With the present state of the art it is not deemed advisable to use relatively low resistance material such as Aquadag over the entire end winding due to the fact that it would fix the entire surface of the coil at ground potential and thus puts full line to neutral voltage on the insulation. This is undesirable because the end turns due to bends and joints cannot be insulated as effectively as the slot portion.



Internal view of the air conditioned room in which thrust bearing runners are machined and finished.

An ideal solution to the end turn problem would be to grade the resistivity of the semi-conducting treatment applied. That is, start with a low resistance value (Aquadag) in the slots and gradually increase to high values at the loops of the winding. This would uniformly decrease the voltage stress on the end turn insulation. This uniform grading of the resistance is not easy to accomplish commercially. It has been found that a single compromise resistance value can reduce the voltage stress sufficiently to eliminate the corona. Such a semi-conducting material, called Coronox, has been applied to windings during the past year. Actual experience indicates that complete visual elimination of corona at operating voltages can be obtained by using a single value of surface resistance.

Since the introduction of the use of Coronox in 1941, it has been successfully applied to the stator end windings of several million kva. of Westinghouse built synchronous condensers, frequency changers, water-wheel generators, and turbine generators for voltages of 11,000 and above.

Application of Coronox has been made to existing machines in the field, but such consideration should be given only where actual damage from corona has been observed. Not only must the winding surface be clean and dry before application can be made, but the rotor usually needs to be removed. These steps cause delay and great expense, and are generally neither necessary nor justified economically.

Damper Windings

Damper windings are supplied in the pole faces of water-wheel generators only when called for by the contract specifications. Such windings are frequently specified for water-wheel generators which are required to operate as synchronous condensers during low water conditions, or which supply power over long transmission lines. In the case of long transmission lines the capacity, reactance, and resistance coefficients may be such that a resonant circuit may exist and, without a damper winding, may impose high voltages as the generator winding or protective equipment under line to ground faults at points remote from the generating plant. When damper windings are supplied they may or may not be connected with the interpolar space, depending on the required relation of the sub-transient reactances on the direct and quadrature axes.

Thrust Bearings

All Westinghouse vertical water-wheel generators and many by other manufacturers are furnished with the adjustable shoe type thrust bearing which was developed in the United States by the late Dr.

Albert Kingsbury and in England by Mr. A. B M. Michell. Although the performance of this type of bearing has been outstandingly good, bearing failures occurred on a few large units about three years ago during their initial starting up period. As a result of these bearing troubles a general investigation of the thrust bearing problem was undertaken.

This investigation programme included two basic lines of approach: One included the measurement of bearing loading, starting torque, and oil film formation on a number of large water-wheel generators under actual operating conditions and the other included a more comprehensive laboratory investigation of small model thrust bearings under different arbitrarily determined conditions.

Tests on Water-Wheel Generators in Service

Field tests were made on six vertical water-wheel generators ranging in rating from 30,000 to 82,500 kva. and at speeds from 100 to 180 rpm. Measurements were made of bearing load, and shaft torque and speed during the starting period. The bearing load was obtained by measuring the elastic deformation of the vertical studs which support the thrust bearing shoes. The combined starting and accelerating torques were obtained by measuring the angular distortion of the rotor shaft over a given portion of its length. Both measurements were obtained by using resistance and magnetic strain gauges appropriately mounted on the respective parts. The shaft speed was determined by measuring the length of wire unreeled from the shaft during a definite time interval as it rotated. A given number of turns of resistance wire was wrapped around the shaft initially and the unreeled length determined by measuring the resistance of the unwrapped portion. These tests showed that the coefficient of friction at instant of start varied from minimum values of 0.15 to maximum values of 0.45 or a range of 3 to 1. The magnitude of the friction coefficient was influenced to a certain extent by the length of time the unit was at stand-still preceding the start. In the case of several of the generators which had been started several hundred times during normal operation prior to the tests, the average value of the coefficient of friction was 0.2. In the case of other machines which had not made many starts, and in which the surface finish of the thrust bearing runner was not quite so good the average value of the friction coefficient was 50 per cent greater. Although it was difficult to obtain accurate values of the speed at which an effective oil film was formed, the data indicates that oil film of sufficient thickness to eliminate metal contact between the rubbing surfaces did not occur until speeds on the order of 30 to 50 rpm. were reached.

The results of these tests show definitely that: (a) the magnitude of the coefficient of friction during start is directly proportional to the thrust runner smoothness coefficient; (b) the oil film tends to be formed at lower speeds as the surface finish improves.

Research Tests on Bearing Model

The research investigation included a quantitative determination of the effect of runner finish, shoe contact area, unit pressure, runner material, shoe material, oil oiliness, and other factors on bearing performance for different starting conditions.

Starting tests were made on runners having various surface smoothness readings as obtained by the conventional profilometer. Variations were made in the temperature at start as well as in the load on the bearing. The load was varied from 200 to 800 lb. per sq. in. Additional tests are to be made to determine the effect of oiliness as well as the different shoe lining materials.

Results obtained from the tests on the model thrust bearing were as follows:

(a) The static coefficient of friction decreased from 0.45 for a runner with a relatively inferior finish to 0.19 for a runner having a very good surface finish.

(b) Using the same runners as in (a) with a load of 400 lb. per sec. on the shoes, the speed necessary to lower the coefficient of friction to .01 changed from 32 to 8 ft. per min. The lower peripheral speed being associated with the runner having the better finish.

(c) The friction during a stopping cycle was approximately one-third of that during a starting cycle.

(d) In the case of the runner with a very fine surface finish and a bearing load of 400 lb. per sq. in., a change in shoe temperature from 30 to 80 deg. C. resulted in:
   (1) An increase in the coefficient of starting friction from 0.19 to 0.27 (50 per cent).
   (2) The speed required to lower the coefficient of friction from its initial value of 0.19 at start to 0.01 increased from 8 to 17 ft. per min.

(e) The average shoe fitting job accomplished by scraping the shoe to fit a surface plate on the runner gives a fairly uniform spot contact over the shoe surface. The spots are relatively small in area, however, and, from measurements made of them, appear to represent only 3 to 5 per cent of the actual shoe area. One start, with the runner having the rather inferior finish changed this contact area from 3 to aproximately 70 per cent of the entire area of the shoe. Five starts increased it to 78 per cent and 75 additional starts improved it to only 88 per cent, indicating a very rapid wear of the surface of the shoe during the first few starts.

In contrast to this wear, the runner having the very fine finish produced a change from 3 to 4 per cent in the first start and after a total of 80 starts had increased the surface contact area to only 15 per cent.

Finishing Process

During the past several years we have used the lapping process to finish the runner surfaces of all thrust bearings. At the time this thrust bearing investigation was started it was decided to explore to the fullest extent the possibilities of the lapping and stoning processes.

In the case of the lapping process, it was found that the design of the lapping equipment, quality and fineness of the lapping compound, fluidity of the lapping mixture, kind of runner material, and procedure followed were vital factors in producing a fine surface finish. It was further found that the lapping process if properly followed will inherently give uniformly flat surfaces free of waviness.

The rather extensive trials with the fine stoning process demonstrated that it will give lower profilometer readings on cast iron runners than we have been able to obtain to date with the lapping method. However, it will not give as flat runners as the lapping process and requires the use of greater precision machining tools and higher skilled tool operating personnel. Furthermore, this method requires two to three times the polishing time to finish the runner.

In evaluating the results obtained with the two methods from the standpoint of surface finish, flatness, waviness, and time required to produce the results it was decided that lapping was the preferred method. Our general experience with both methods indicated that it was essential to have high quality precision machine tools, skilled mechanics, and clean surroundings in order to produce reliable and satisfactory thrust bearings for water-wheel generator applications. In carrying out this programme a new precision type 10-ft. boring mill was purchased and installed in a special room equipped with precipitron cleaning and temperature control.

Although a paper covering these thrust bearing investigations will be presented before an appropriate organization, it is in order to give here some of the results and conclusions which were reached.

(1) Adequate surface finish quality can be obtained for thrust bearing runners for any size now in use or contemplated for future use.

(2) Thrust runners can be produced in which the bearing surface is sufficiently flat and free of waviness that thrust shoes with machined surfaces can be used without scraping the shoes to fit the runner surface.

(3) Satisfactory thrust bearing runners can be produced from steel forgings, alloy cast iron, and chilled cast iron provided the Brinell hardness of the surface material is in the range of 175 to 250 B.H.N. Properly produced chilled cast iron with its uniform close knit grain structure appears to be the most satisfactory and economical material for this application.

(4) During the initial starting up period, the rotor should be lifted for the first half dozen starts so that the surface contact conditions can be improved with the minimum hazard to the bearing.

(5) During the initial starting up and starting up in the early operating periods, the temperature of the bearing shoes or lubricating oil should not exceed 40 deg. C.

(6) The viscosity of the lubricating oil for larger units should be of the order of 275 and 325 S.S.U. at 100 deg. F.

Hypersil and Cobalt Steels

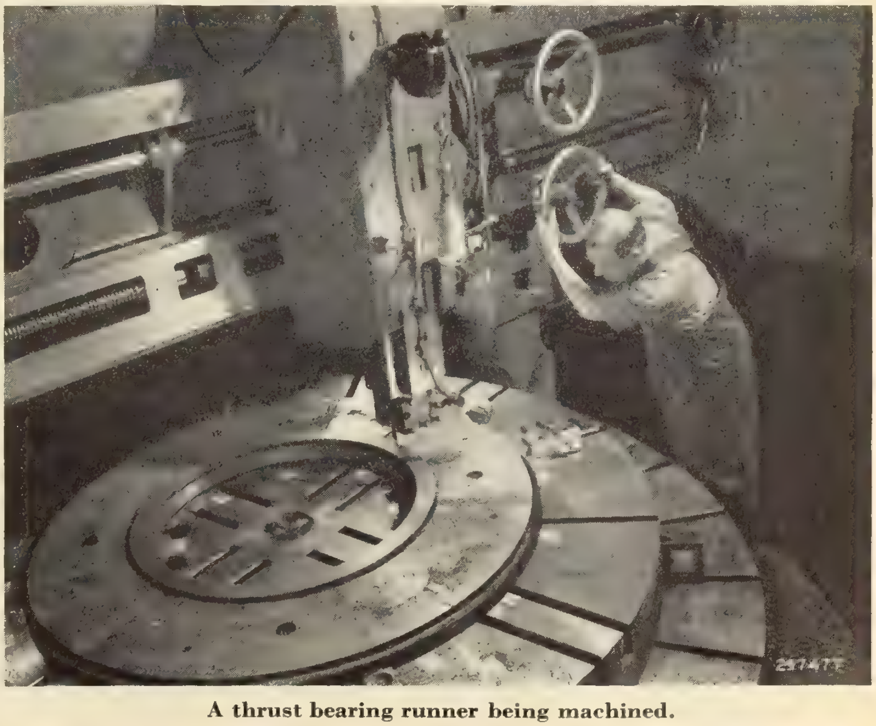
The new low loss hypersil type of steel which has resulted in spectacular changes in the physical proportions and efficiency characteristics of transformers does not offer the same possibilities when applied to generators. Hypersil has different loss and permeability characteristics when magnetized on the axes parallel and perpendicular to the grain lines that inherently result from the rolling operations. Since the magnetizing flux passes down the teeth in one direction and traverses the core at right angles, the loss characteristics would be good for the teeth and bad for the core or vice versa. A compromise could be obtained by punching the segments from the sheet so that flux paths in both core and teeth are at the optimum angle with respect to the grain flow lines. Although the problems associated with the use of this material for rotating machines are difficult of practical solution, effort is being made to find ways and means to take full advantage of it for this and other applications. At the present time this steel is relatively costly and its use may result in an appreciable improvement in efficiency with little or no reduction in cost.

There is also available, in limited quantities, a new cobalt steel which has high permeability and would be suitable for use in the highly saturated field pole sections. Its use would increase the flux capacity of the rotor magnetic circuit and would result in increased output for given physical dimensions. At the present time the cost of high permeability cobalt steel is many times that of conventional rotor pole steel and its use is only justified in those applications where reductions in weight and physical dimensions are the influencing factors and cost is a secondary item.

Both hypersil and cobalt steel are inherently costly steels due to the relatively large amounts of nickel and cobalt involved—both of which are relatively costly. However, it is expected that both materials have possibilities of appreciable cost reduction when produced in much larger quantities.

Silicone Resins

The use of silicone resins in electrical insulation is arousing considerable interest because of the great increase in thermal endurance which they provide. Their availability was announced by the Dow-Corning Corporation a few months ago. The development of these resins and their application to electrical machinery as high temperature insulation has been closely paralleled because of cooperation between Dow-Corn-



A thrust bearing runner being machined.

ing and Westinghouse. Several technical articles have described Westinghouse experience in the development of high temperature silicone insulation and its experimental application to electrical machinery.

Silicones are a new class of heat stable synthetic resins intermediate between glasses and silicates and the organic plastics. They are derived from sand, brine, coal and oil. Their chemical structure corresponds to the hydrocarbon resins except that the molecules are built up around a silicon-oxygen " backbone " instead of one with a carbon-to-carbon linkage. The thermal stability of the silicon-oxygen bond is responsible for the excellent heat resisting properties of the silicone resins.

Silicone resins are available as varnishes in forms similar to the usual varnishes used by the electrical industry. They have been used with mica, glass, and asbestos to produce the following HTS insulation products:

(1) Silicone-glass cloth as a backing for composite insulation.
(2) Silicone-glass-mica wrappers for coil insulation.
(3) Silicone-glass-mica tape for coil insulation.
(4) Silicone-glass tape for protective external covering of coils.
(5) Silicone-glass covered copper wire.
(6) Silicone-asbestos cloth for padding and structural uses.

These insulating materials have been used for insulating magnet coils, windings of induction and traction motors, electric propulsion equipment, and stator windings of a-c generators. To date all applications have been for relatively low voltage windings. Materials and processes are not yet available for windings above 4000 volts. The performance has been good in all cases but it must not be assumed that the insulation problems are all settled. It is fully expected that the improved thermal endurance can be utilized in three important ways in the design of electrical equipment.

(1) To reduce the size and weight of electrical equipment where operating temperature can be inincreased and where no reduction in insulation life can be tolerated.
(2) To increase greatly the service life of insulation where conventional size, weight, and temperatures are maintained.
(3) To permit operation in ambient temperatures materially above limits permissible for usual types of insulation.

It is our feeling that there are a few cases in power plant operations where application of the HTS insulation could be seriously considered at present for trial installations. One would be for motors driving induced draft fans in locations with high ambient temperatures. Another would be for difficult applications where totally enclosed fan cooled motors could be used.

It is our purpose to carry out the application development of this new insulation in an orderly and progressive manner. At present the materials are available in relatively limited quantities, and costly, approximately 8 to 10 times that of a good insulating varnish. Much is still to be learned about methods and processes of handling silicone resins and varnishes. Additional manufacturing equipment such as high temperature baking ovens, processing tanks, etc., will be required. The application of this new HTS insulation is to be made on a restricted production basis. With satisfactory manufacturing and field experience the use can be extended at any desired rate.

JAPANESE PAPER BALLOONS

R. W. McKAY

Canadian Army Operational Research Group, Department of National Defence, Ottawa.

Information was released some time ago, through the daily press, of a strange new weapon, the Japanese paper balloon which has reached our shores spasmodically since the autumn of 1944. Relaxation of the requirements of security now makes it possible to present some technical details regarding their construction and performance. Plotting the distribution of the balloons from Alaska to Mexico and from Hawaii to Michigan and tracing back their origin to the shores of Honshu was not only an interesting study but may well add valuable information to our somewhat scanty knowledge of the winds of the upper atmosphere. Before discussing these questions, however, some description of the balloon and its functioning is necessary.

Description

The balloon itself is made of paper, is spherical in shape and 33 ft. in diameter. A sketch of a fully inflated balloon is shown in Fig. 1. After losing some hydrogen, however, the balloon tends to resemble a parachute. Just below the equator is attached a paper skirt reinforced with rope at its edge, which forms the attachment for 19 shroud lines, each 45 ft. long. The shroud lines are gathered together at their lower end and knotted to a steel ring. Supported from this ring by four double ropes is the mechanism shown in Fig. 2, which controls the height of the balloon. A valve 18 in. in diameter is fitted to the bottom of the balloon envelope and serves to limit the excess pressure of hydrogen to approximately ½ oz. per sq. in., which is well below the pressure set by the bursting strength of the paper.

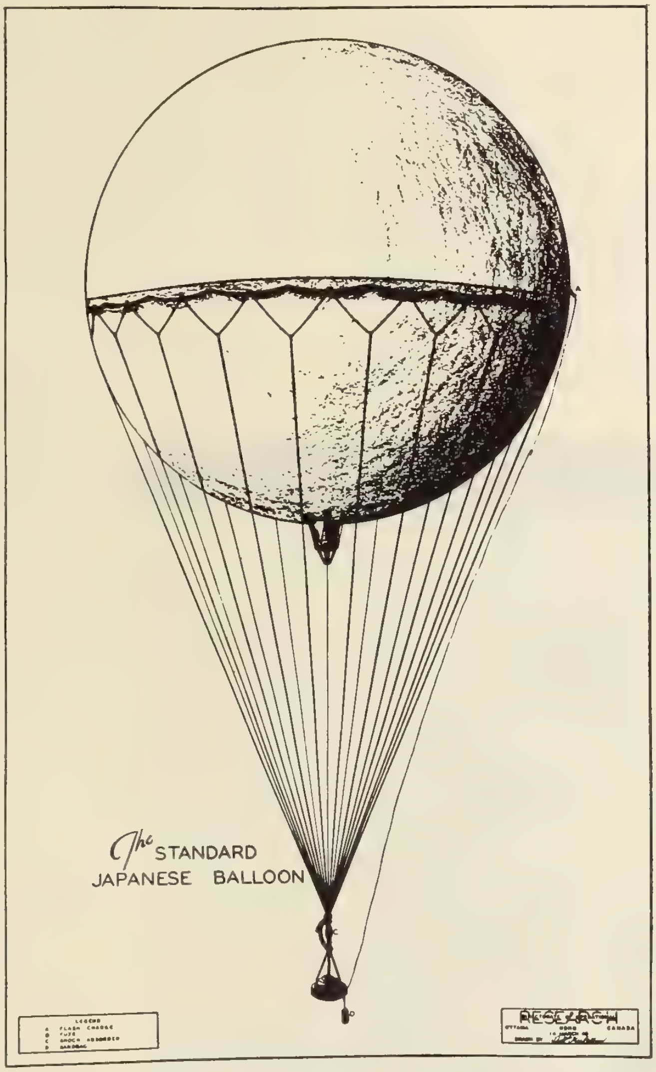


Fig. 1

Figure 2 shows a photograph of the ballast release gear assembled from the remains of various units found in Canada. The large ring (1) contains 72 holes, numbered in pairs from 1 to 36 as in Fig. 3. When the balloon is launched, there are blow-out plugs (2) containing black powder pellets, in all the holes except the pair marked 36. Opposite the blow-out plugs 35 pairs of 2-ft. lengths of sand coloured safety fuse (3) are fitted by means of threaded brass attachments. These fuses terminate in brass plugs (4), which fit into holes, almost diametrically opposite in the small ring (5). When each brass plug is in place it holds open a spring switch (6). These switches, which connect with contacts on the bakelite disc (7), are also numbered from 1 to 36. The number of the switch is one higher than the number of the large hole at the other end of the fuse. The blow-out plugs are connected to the electrical circuit by means of pin jacks (8) mounted on the red fibre rings (9). Two 33-ft. lengths of green coloured safety fuse (10), which are normally wound round the four iron posts (11) terminate in brass plugs fitting in holes No. 1 in the small ring.

Above the bakelite disc is a wooden box (12), in which are four barometers mounted on a false bottom (see Figs. 4 and 5). On the top of the wooden box is a transparent celluloid box (13) containing a smaller celluloid box filled or partly filled with water. Inset in a cavity in the bottom of the inner box, but sealed off from its contents, is a 2-volt storage cell.

The greater part of the load carried consists of paper sandbags (14) each weighing about 5 lbs., tied to hooks (15). The hooks fit into T pieces (16), the arms of which are supported by the blow-out plugs. Four incendiaries (17), each weighing 10 lbs., are also carried. There are wires (22) tied on to the equipment, which are arming wires for bombs or incendiaries.

The weapon is fitted with two self-destroying devices. The 2½ lb. picric acid demolition block (18) is tied on to the wooden box. It is initiated by a detonator and fuse (20), the other end of which fits into one of a pair of holes, similar to those in the large ring, in a small iron casting bolted to the centre of the metal cross piece of the ring. The other hole is fitted with a 60-ft. length of safety fuse (21), which leads to a flash charge fastened in a sleeve cemented to the envelope. Two blow-out plugs fit into the ends of these holes. A rather larger T piece is supported by these two plugs, and this carries the larger bomb

(23), which has been incendiary in some cases and of anti-personnel type in others.

Method of Operation

The balloon is designed to operate at a height of approximately 5 miles, and to stay aloft for about a week. This is accomplished by an ingenious ballast-dropping mechanism which operates whenever the balloon falls below its operational height. The wiring diagram is shown in Fig. 3. When the balloon is launched, all the switches F, G are open. The contacts on the four barometers are shown in Fig. 3 as A, B, C and D. Barometer A, the central one, Fig. 4, has a differential mechanism which automatically sets itself to close the contact at approximately 2500 ft. below the highest level reached. Barometers B and C are simpler mechanisms and set to operate at an altitude of about 5 miles. They are connected in parallel to A and act as alternate devices if A fails. Closing of contacts A, B or C will connect the battery from the ring of contacts G to the ring J.

As the balloon is launched, the long green fuses are ignited by means of friction igniters (19) and after about ¾ hour they have burnt through to the brass plugs in holes No. 1 of the small ring, which are blown out and the corresponding switches closed. The battery is then connected through the barometers to the pin jacks No. 1. By this time the balloon should have risen far enough for the barometer contacts to be open. When the balloon drops below its operational height a barometer contact closes, and the plugs No. 1 in the large ring are blown out of their holes, releasing a sandbag, and at the same time igniting the fuses leading to switches No. 2. During the burning of these fuses (2 to 3 minutes), the balloon again rises to its operational height. This process continues until all the ballast has been dropped. To guard against failure of the pyrotechnic system all the plugs and fuses are in duplicate.

When the switches No. 36 have closed, one of the centre plugs is connected through the barometers to the battery. This plug is blown out as soon as the balloon again drops below its operational height, the load carried by the centre plug is released, and the fuse to the flash charge on the envelope is igntied. This fuse is, of necessity, a long one and takes over an hour to burn through. The second self-destruction device, consisting of the demolition block, detonator and fuse, is connected to the battery through switch No. 9 and barometer D. This barometer is set at a lower altitude (about 15,000 ft.) than the others, so that if, at any time after switch No. 9 has closed, the balloon drops to a low altitude and the ballast release gear is destroyed. A connecting hole between the two plugs appear to be intended to cause both self-destruction devices to operate if one does. The surprising frequency of failure of both devices has resulted in a high proportion of the balloons being found intact.

An interesting variation in the circuit is found in most of the balloons recovered since February, and was first noted in the balloon which fell at Provost, Alta. The contacts on barometer B are in series with the rest and do not close until the balloon reaches 10,000 ft. The only possible value of this change is to act as a safety device, preventing premature operation, even if an error has short circuited the starting switches. One may wonder whether a serious accident occurred which caused the Japanese to introduce this change.

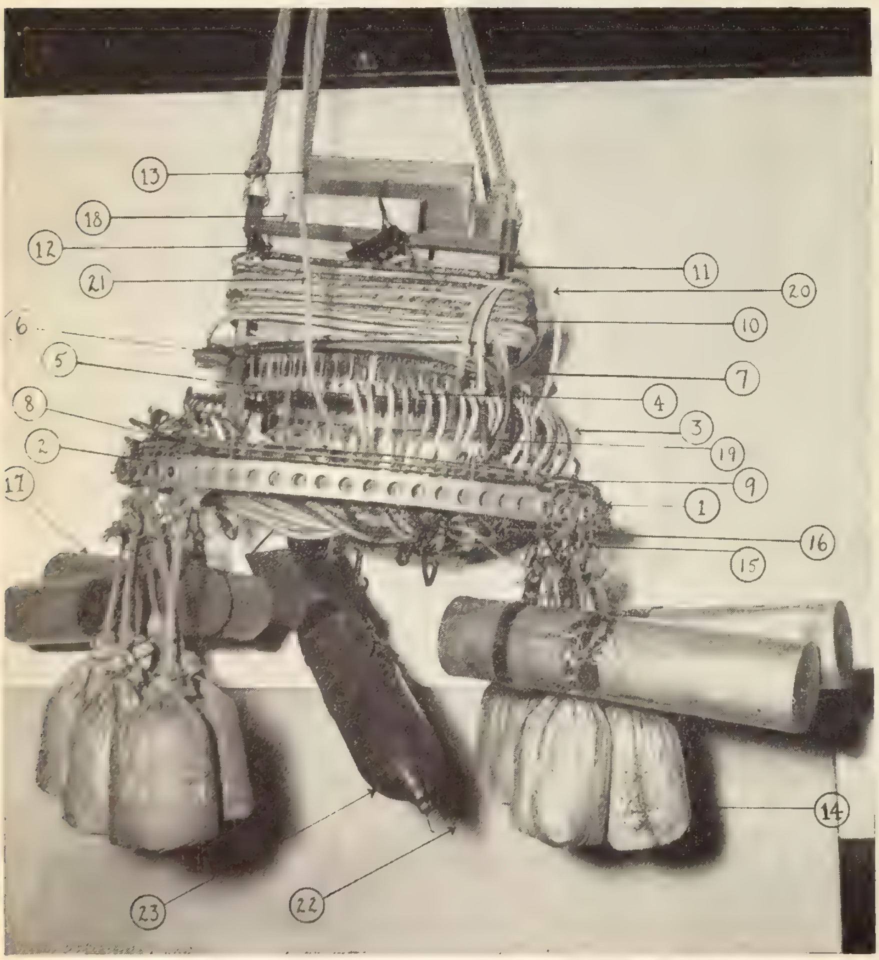


Fig. 2—Mechanism controlling the height of the balloon.

Materials Usfd

The materials used are not of unusual interest although the presence of natural rubber in the insulation and as a gasket in the gas valve and also in some cases as a shock absorber in the suspension, indicates the availability of this material. The rings (1) and (5) and the blow-out plugs (2) are aluminum castings showing no special properties or techniques. The safety fuse differs from construction standards here. It is wrapped with layers of twisted paper instead of thread, contains more powder, loosely packed. It burns more slowly and will continue to burn at higher altitudes.

The material of the bag itself is of some interest. It is made up

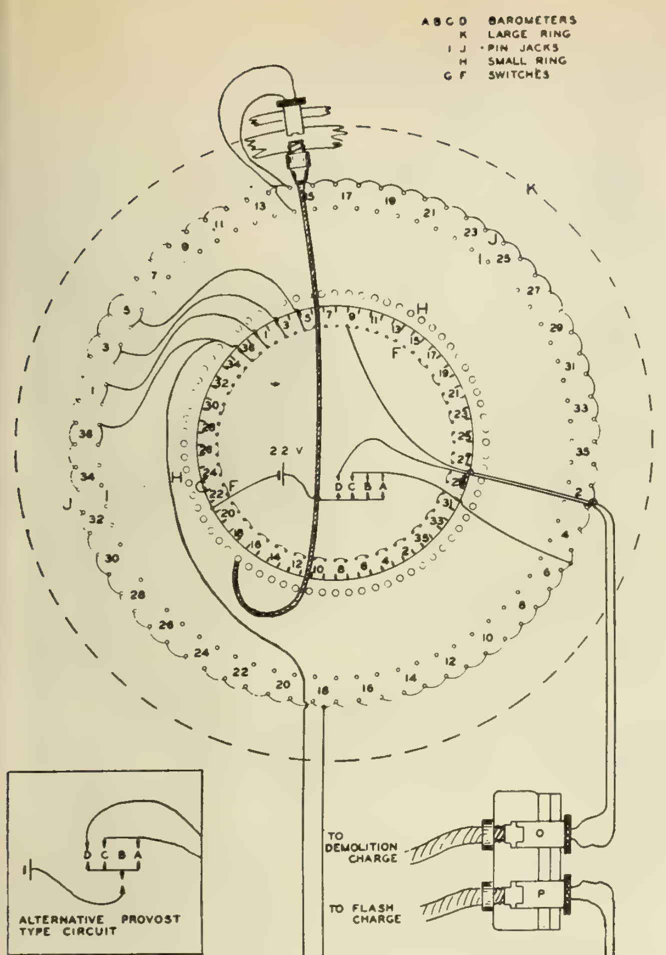


Fig. 3—Wiring diagram.

of four plies of hemp fibre paper cemented together and coated with a material similar to agar-agar. Under favourable conditions its hydrogen permeability is much less than that of rubberized fabric, but due to creasing and exposure it is so variable in samples tested that it is difficult to quote a representative figure.

Use of Solar Heating

The two-volt cell which actuates the control mechanism differs from standard only in employing somewhat stronger acid. While this modification appears to improve its low temperature performance it is doubtful if the cell would function satisfactorily if it fell to the very low temperature (about —60 deg. F.) of the air at 30,000 ft.

The device used to maintain the battery above the temperature of the surrounding air is simple and cheap, and makes use of solar heating. A lot of talk is heard of solar heating and this actual application is therefore of interest. The 2-volt cell which activates the ballast-dropping device of the Japanese paper balloon is mounted inside a double celluloid box, full of water, which has been previously described.

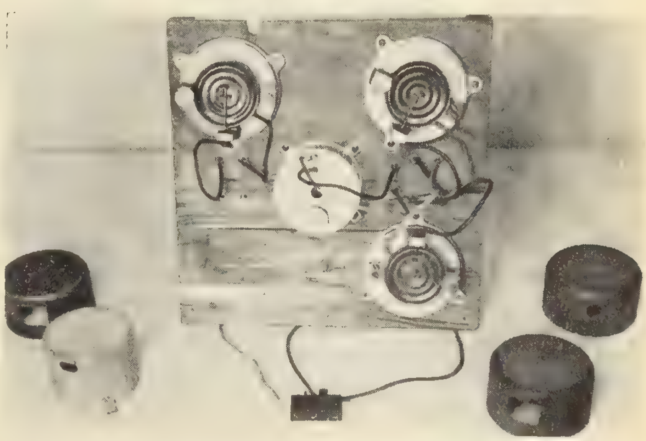
Use of the transparent celluloid box allows the sun's heat to penetrate and warm up the contents of the box, while heat losses are all from the surface, since the celluloid is opaque to heat radiations corresponding to the temperature within. The double box with its air space improves the insulation. The fact that the balloon has zero air-speed greatly reduces convection losses, which, in any case, would be only half as great in the rarer air at 30,000 ft. than at ground level, being roughly proportional to the square root of the air pressure. Thus it may be shown that, as the balloon is in sunshine all day, above the level of clouds, it will absorb enough energy each day to make up for heat loss at night, and that the insulation is sufficiently good to prevent excessively low temperature during the night.

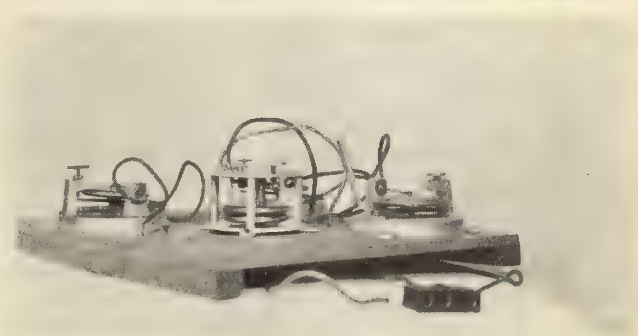
Lifting Power

The balloons when filled with hydrogen have a lifting power at 30,000 ft. amounting to about 200 lb. in excess of the weight of the envelope. As the balloon warms up during daylight the internal pressure increases and gas escapes through the valve. During the night, cooling occurs and the balloon sinks below the level at which the internal and external pressures are equal, and begins to become smaller than its fully extended size. In this condition it is unstable and would continue to sink to ground level but for the ballast dropping mechanism. However, when sufficient ballast is released to compensate for cooling the balloon again becomes stable and the same process is repeated on successive days. As gas is lost each day by valving and leakage, the height at which the envelope becomes fully expanded and therefore stable becomes higher and may be as great as 40,000 ft. before the end of the trip.

Origin of the Balloons

When balloons were first found it was thought that they might have been released from submarines near our coast but when examination of the balloons showed that they were capable of remaining aloft for possibly a week this view was revised. Throughout the temperate zone, there is a general movement of the atmosphere from west to east and it is well known





Figs. 4 and 5—Showing arrangement of barometers for establishing electrical contacts which release the ballast.

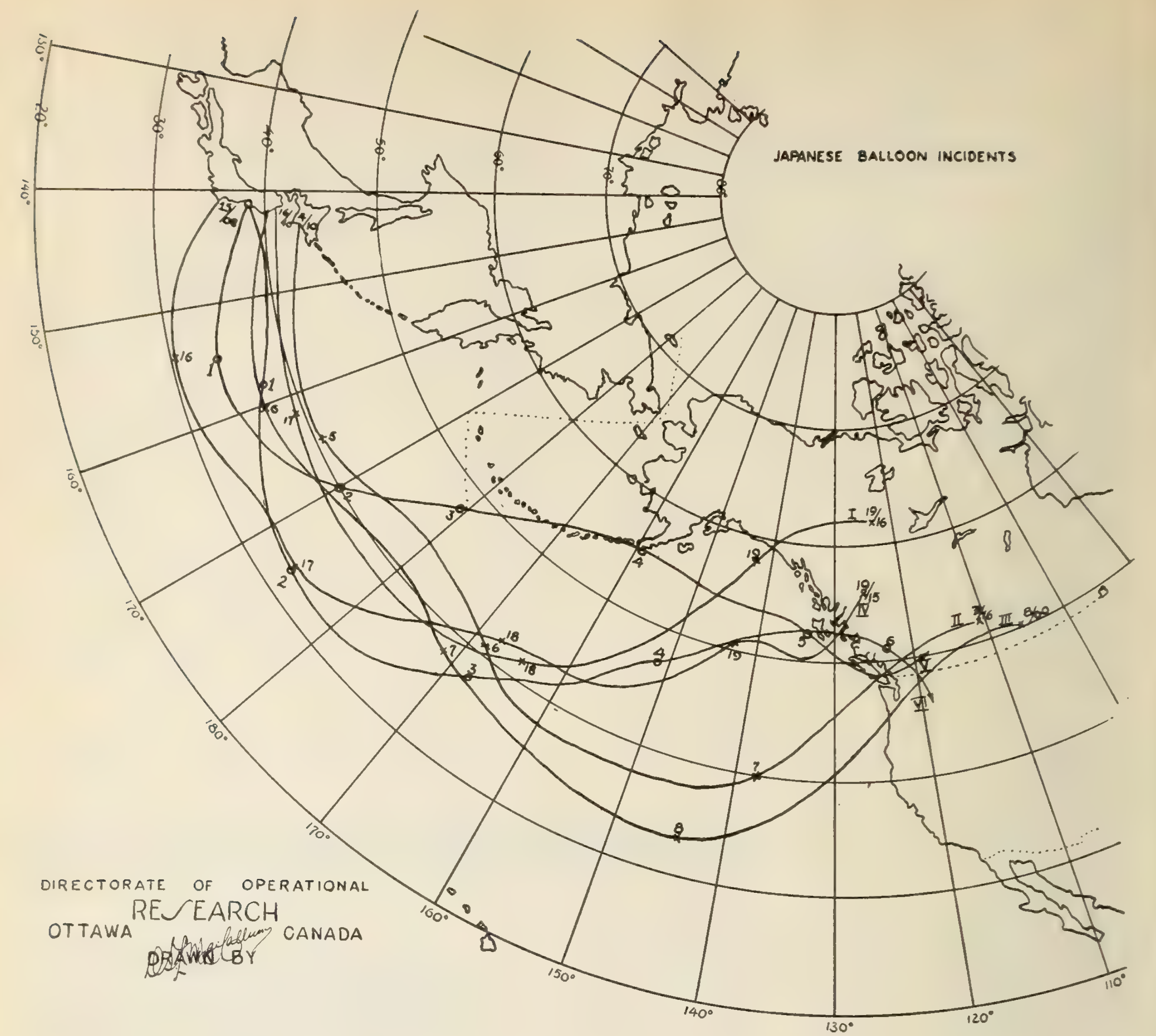


Fig. 6—Paths of the balloons are traced backward to their origin.

that, at greater heights, this drift becomes more consistent and the wind velocities become higher. While actual wind data above the Pacific are somewhat scanty, enough information was available to enable the paths of balloons to be traced backward when the day and hour of their landing was known. Some sample charts worked out by Mr. R. W. Rae of the Dominion Meteorological Service from data for 30,000 ft. are given in Fig. 6.

Curves I, II, III, and IV are drawn back from the points at which four balloons landed, namely:

I	Fort Simpson, N.W.T.,	19 Jan.
II	Provost, Alta.	7 Feb.
III	Parkbeg, Sask.	8 Feb.
IV	Takla, B.C.	19 Feb.

The numbers along these curves indicate the date. All these trajectories originate in the Japanese Islands but this method of locating the point of origin of the balloons is not sufficiently accurate to fix its location closer than ± 5 deg. of latitude.

Curves V and VI are drawn forward from Sendai, Japan, to correspond to the courses balloons would have followed starting on July 19 and Aug. 14 of 1944. Curves for 1944 were drawn because data was not available for any other year. The numbers along those curves are days away from Japan.

It will be noted, for example, that the balloon reaching Parkbeg (Curve III) was less than four days on the way and must have travelled 6,000 miles at an average rate of 71 miles per hour.

While the winds in the summer are lighter, curves V and VI show that balloons, if released on two days chosen at random in the summer of 1944, would have reached this continent but would have taken about six days.

Number and Distribution

Close to 300 balloons have actually been found scattered across the western half of the continent as shown in Fig. 7. When the large expanses of uninhabited territory in the north are considered, it must be obvious that many remain undiscovered. A statistical study of the distribution of balloons in relation to presence of population and other factors affecting probability of recovery has led to the conclusion that perhaps 1,000 balloons were released from Japan, nearly half of which fell in the Pacific Ocean. The distribution of the balloons follows very nearly the

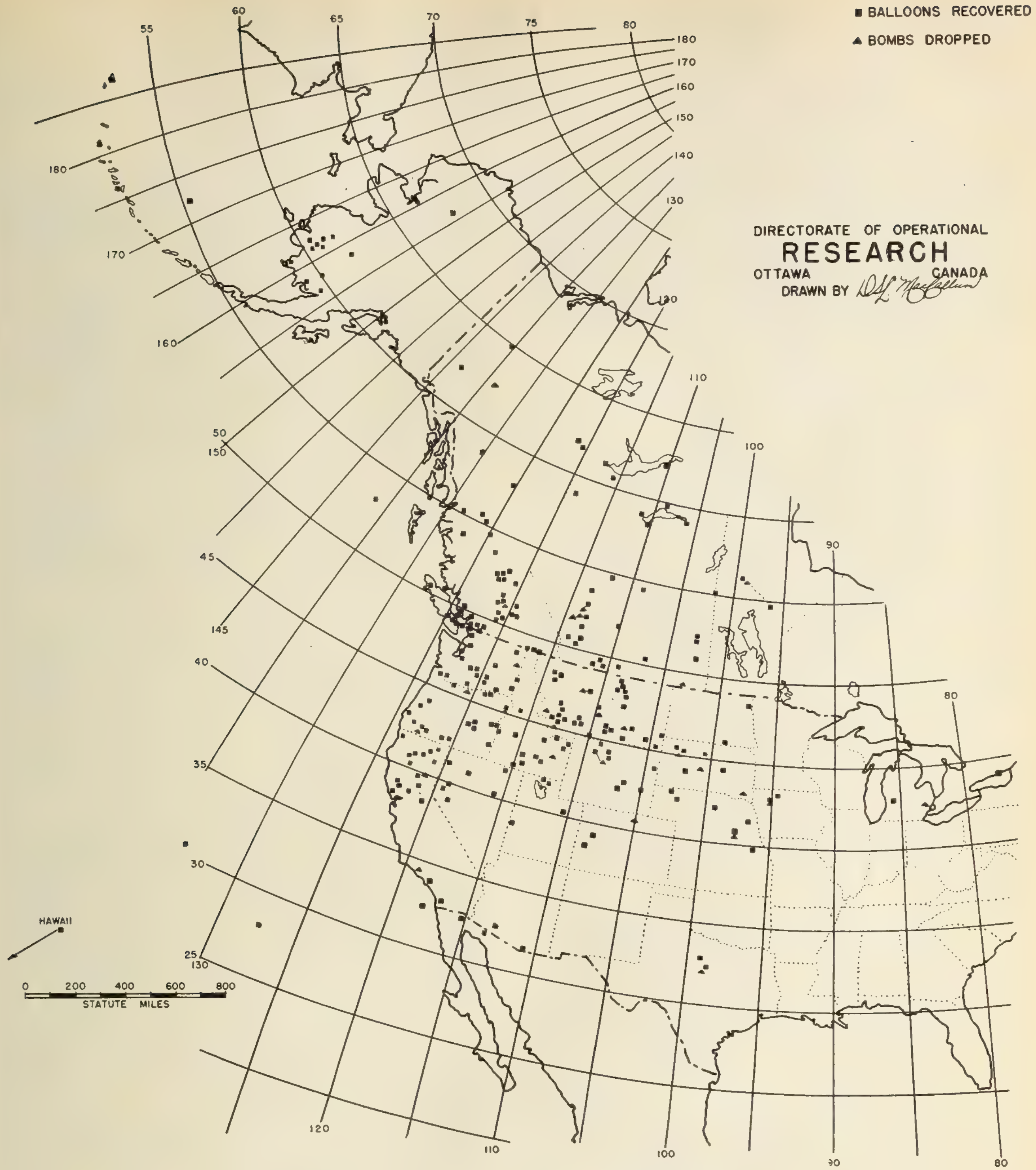


Fig. 7—Showing the distribution of the balloons.

random pattern of shots on a target centered near Vancouver and having 50 per cent zones of 20 deg. of latitude and 40 deg. of longitude. Even in southern British Columbia and northern Washington State where the concentration was greatest, this amounts to less than 20 balloons per 100,000 sq. mi.

The damage caused by the balloons actually was negligible apart from one regrettable accident caused by the handling of bombs by people unacquainted with their dangerous character.

ACKNOWLEDGMENT

Information from districts and commands of the Armed Services in Canada and from civilian sources such as the Royal Canadian Mounted Police and British Columbia Police was passed to National Defence Headquarters. Similarly, in the United States information was centralized in the War Office. A full exchange of information between Canada and the United States existed and its use in the preparation of this account is gratefully acknowledged. Acknowledgment is also made of the use of reports of the National Research Council, Pulp and Paper Institute, Bureau of Mines and the Dominion Meteorological Services.

BATTLE OF THE SCIENTISTS

How The Magnetic Mine Was Mastered

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Battles of World War II have been fought not only in the field, at sea and in the air. Some of the most interesting have been those behind the scenes in which scientists and designers of Britain and the United States have pitted their brains against Germany and Japan. The knowledge thus gained from wartime experiences will have a profound effect on the struggle to win the peace.

Romance of Radar

The most outstanding technical battle — almost a war in itself — was won in the field of radio, including radar (as radiolocation is now known). The development of radar has produced the more startling results. A British scientist first realized the military significance of the discovery that echoes from aircraft of wireless waves interfered with television reception. Driven by the fact that the English Channel was no longer a barrier, all possible research was given to this new method of detection and location. When the great day of trial came, in August 1940, all was ready. In the Battle of Britain it was the pilots behind the guns who shot down the aerial invaders, but it was the band of men behind the radar who led the pilots to their targets.

Radar has not only conquered fog and darkness, it has stimulated the science of electronic physics to such an extent that that science has jumped from a comparatively small size until it is now equal to almost half the total scientific effort in Government Service. Radio valves and cathode ray tubes are to be found in almost every field of war activity, and presumably before long this will be equally true in ordinary life.

Britain led in all of this. She has retained her lead by a very good margin ever since. With the United States she exchanged all information and worked in close collaboration. The Germans copied some details accidentally given them in aircraft lost over the Continent. Admiral Doenitz is reported to have said, when describing how Britain had conquered the U-boat menace by means of radar, " The scientists who created radiolocation have been called the saviours of their country. It was not superior strategy or tactics that gave Britain success in the U-boat war; *but superiority in scientific research.*" The radio war resulted in a demand for physicists such as never before. All specialists in Britain were mobilized and others brought from all parts of the world. Special measures were taken to train new men either from scratch or from other branches of science.

Mobilizing Chemists and Engineers

The major technical battle of World War I was for materials and this was fought by chemists. Britain owed her preparedness in World War II to the strong chemical industry then founded — an industry which is strongly backed by its great research laboratories. The battle for materials has gone on in World War II but has seldom produced such grave problems as it did in the former conflict.

Design engineers come into every battle and this profession has experienced the greatest shortage. It is difficult to know how to produce a good design engineer quickly. People with all kinds of training have helped to fill the ranks but a serious national problem remains.

Menace of the Magnetic Mine

In duration, in technical achievements, and in human effort the battle of the magnetic mine was not perhaps in the same class as the radio or anti-U-boat battles, but it has unique features of interest as the first technical battle of the war and one in which Britain won a decisive and, to Germany, totally unexpected victory. It had important repercussions.

In any battle one must first know what weapons the enemy has to use and correspondingly in a technical battle, especially of a defensive nature, one is very dependent upon technical intelligence. Although Britain was practically certain in October, 1939, that the enemy was using a magnetic mine, she did not know its characteristics accurately enough to make any real progress to its counter.

The story of the capture and analysis of the first magnetic mine has now largely been told both in press and radio. So, too, much has been told about degaussing—that electric safety belt for ships which was divulged to the world on the day that the first degaussed ship arrived in a foreign port. But that is only part of the story—as degaussing was only partial protection it was obviously necessary to get rid of the mines, if possible, as fast as the enemy laid them.

The German magnetic mine was based on a World War I type. If a magnetized rod of steel is supported by a horizontal axle through its centre, so that it is free to rotate in a vertical plane (like a see-saw), instead of in the horizontal plane as in a compass, then the North-seeking pole of the rod will dip down to an angle depending on how far it is from the North magnetic pole. (At the pole itself it would dip to the vertical position, at the magnetic equator it will not dip at all, and south of this the South-seeking pole will dip). By fitting such a needle with an adjustable helical spring one can accurately balance the force tending to make the needle dip by an equal and opposite force of the spring.

Under a steel ship the magnetic field is greater than normal and a balanced needle is forced down to make the electrical contacts.

The German scientists improved on the old design in many ways. One was in devising an ingenious clock which automatically measures and sets on the spring the exact force necessary to balance the magnetic force on the rod in the latitude in which the mine is laid.

The analysis of the first German magnetic mine, on that famous night of November 24, 1939, not only showed the mechanism by which it worked but gave the crucial technical figures of the strength and duration of the magnetic field required to fire it. Without these, counter-measures were barely possible. On that November night the technical battle was joined.

When the full story of this battle is told it will describe the many schemes that were put forward (and some tried) varying from flat fish fitted with bar magnets, to giant coils on aircraft. The story will show the excitement of the first exploded mine, the competition in the rising scores of the runner-up schemes, and the final emergence of one method with such effect that the mine menace never again reached dimensions comparable with that of the first year of the war. This method was the Double L sweep.

The Double L Sweep

"Double L" stands for Double Longitudinal, and the sweep is made up of two minesweeping ships, each towing a long tail of self-buoyant electric cable. The current is generated in the ships, stored momentarily in batteries and passed through both cables simultaneously as a large surge. The current goes into the sea through electrodes. By this means ten or more acres of the sea bottom can be subjected to a magnetic field of sufficient strength and duration to explode all the mines therein. The ships proceed on their parallel courses and make a second "surge" of magnetic field. In this way is cleared a continuous line of the sea bottom, providing a safe channel through which ships can pass.

The advantages of the Double L are fairly obvious; the sweep is easy to tow and to handle, and does not foul wrecks and buoys. It is not damaged by the explosion of mines and it will sweep a large area with 100 per cent effectiveness.

The original Double L sweep was constructed on the shore of the Isle of Grain near Sheerness, and towed behind a tug. It was made from cable used for charging submarine batteries, and floated on logs originally intended to make masts in H.M. ships. On a cold winter's day in late December, 1939, two tugs, filled with motor car batteries, and each towing one of these giant "snakes" left Sheerness Harbour for the first full-scale trial. This trial confirmed the scientists' calculations of the current through the sea and of the magnetic field, but ended in one tug being marooned on a mud-bank with its giant "snake" wound around its propeller!

However, the answer was there, and that evening the orders went out from the Admiralty for the final modifications to the big programme of production, fitting out of ships, training of men, which had been laid on in anticipation of success. The logs, of course, gave way to self-buoyant cable designed and produced by two of the leading British cable manufacturers.

Lessons Well Learnt

There are some general lessons to be learnt from this battle. Many think that the Germans made a mistake in laying their magnetic mines in penny numbers, giving Britain time to have counter-measures ready before their big campaign the following spring. This, however, was only a small part of their error, because the battle of the magnetic mine had repercussions on the whole position to be taken by science in the British defence organization. While there were many people who fully realized before the battle that this was going to be a very scientific war, there were many more who had still to learn. The menace of the magnetic mine changed all that almost over-night.

This was surely a new type of war if it introduced weapons which could lie quietly hidden but which would explode if merely approached by a suitable target. Magnetism, which had always been a friend to a sailor as it gave him a means of navigating his ships, had suddenly turned into a dangerous enemy, not to be fought solely by guns and bravery but by amps and volts and gauss! *Science was in the war.*

This lesson of the Battle of the Magnetic Mine was out of all proportion to its technical importance compared with radar which was a much bigger thing even at that time. The radar battle, if it could by then be called a battle, was surrounded with an enormous wall of secrecy, whereas, the menace of the magnetic mine permeated not only everywhere in service circles, but to the whole British public.

Science and Peace

It is difficult to recall the atmosphere of those early days in viewing the position now, when science and scientists appear in almost every part of the Admiralty and other Government organizations, far more than they ever penetrated into industry. One of the biggest tasks after the war will be to ensure, as far as possible, that a similar change takes place in circles outside the Services. There are, of course, some industries which are and have been for a long time, very progressive, but there are still far too many in which the reverse is true. Other Government Departments, whose importance will return with the peace, must also learn to make full use of science in their work.

The lessons of the Technical War are just as great for scientists. Men who had never been outside a laboratory learned how to work in a team with engineers, manufacturers and naval officers. They learned how to make decisions, or how to lay out evidence so that others could make decisions and they learned how to compromise. They learned to make things happen at a speed unknown to them before, and they drew their satisfaction not so much from the new knowledge that they discovered, as from watching the results of the products of their brains at work in the Battle of Lives in the field. They learned also that specialization has its weaknesses; that a real appreciation of the fundamentals of science, of its basic laws, its logic and methods of working, is more important than masses of detail. World War II will end with thousands of scientists having quite a new outlook. Will they keep it, and if so, what will they do?

The answer to this question is plainly before us. This war will give place to another war — a war to win the peace, a war in which the enemies are not nations but unemployment, poverty and all causes of human suffering. Britain and the whole world is looking to science to play its part in the technical battles of peace, just as it has in war. On its record in World War II, British science can do it.

DIESEL-ELECTRICS IN INDUSTRY AND TRANSPORTATION

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Paper presented before the Montreal Branch of The Engineering Institute of Canada, on February 8th, 1945

Those who are associated with railway transportation appreciate the fact that a progressive change is taking place to not only meet the new traffic demands but also to cope with ever-increasing competition.

The form of power which made rail transportation such a vital force in world development is steam power. For about a century the steam locomotive ruled supreme. However, since about 1900, electrification has played an important part in the handling of certain types of traffic. For many years this provided a second choice, and electric traction is still preferred where the volume of traffic is particularly large. Now a third type of locomotive—the Diesel-electric—has developed into a tried and proved source of propulsion power.

The use of electric locomotives is predicated upon the development of electric power supply and installation of power lines, feeder lines and trolleys to satisfy maximum demands. The locomotives often have greater potential horsepower than either steam or Diesel. The Diesel-electric, with its added flexibility, displays operating characteristics identical with those of the electric locomotive, except that its maximum capacity is limited to that of a portable power plant; but it embodies the important advantages of both electric and steam power. The difference in capital investment required for the steam locomotive and its Diesel-electric counterpart is constantly being narrowed as the cost of steam power increases with refinement, and the Diesel cost is reduced through standardization and mass production methods.

Development

The application of the Diesel engine to locomotive work began on this continent about twenty-five years ago. There were two separate developments—rail cars intended for light passenger service and small locomotives for switching services. The rail car developments over a period of years produced the high speed, streamlined passenger trains, and the Diesel switcher has widened its field of action to take in all types of industrial switching as well as increasing the scope of its railroad work, and has lead to the inauguration of Diesel road locomotives in freight service.

In the first ten years following the introduction of Diesels for switching, there were but a few placed in service. From 1935 on, they increased very rapidly and, in recent years, the building of steam locomotives for this purpose has practically ceased. A further indication of the extent to which Diesel power is being adopted by the railroad for main line work as well as switching is given in Table I which also gives the comparison with steam and electric locomotives.

It will be noted that the number of Diesel-electrics placed in service exceeded the steam locomotives each year since 1937. During the years from 1940 until the end of 1944 the report for domestic locomotives shows that 72 per cent of the total locomotives placed in service in the United States were Diesels.

Description

The construction of many of the early locomotives was of the box type with an operating compartment at either end and diagonally opposite, which permitted the operator to work from either side of the locomotive at his convenience. Vision in one direction was practically perfect, but in the opposite direction it was not as good. This objection was overcome by two other cab arrangements. One of these is known as the "steeple cab" and has the operating station in the centre of the locomotive above and between two narrow engine hoods. This places the operator three or four feet above the main frame, and the low, narrow housings permit a good view in either direction. This arrangement has been adopted for industrial and light railway work where the locomotive is equipped with two engines. On the 660 and the 1,000 hp. switchers the arrangement which has been generally accepted is similar, with narrow housings and operating cab raised, but it must be located at one end of the locomotive due to a single, large engine being employed. This gives an entirely unobstructed view in one direction and, as compared with steam locomotives, a very much improved vision in the other.

Detailed attention has been given the operator's comfort, with the realization that his efficiency can thereby

Table I—Locomotives Ordered, 1929-1944

Year	Domestic				U.S. Export	Canadian (Inc. Export)
	Steam	Diesel	Electric	Total		
1944	74	670	3	747	134	324
1943	413	635	..	1,048	60	241
1942	363	894	12	1,269	32	53
1941	293	937	38	1,268	85	79
1940	207	492	13	712	85	3
1939	119	249	32	400	40	56
1938	36	160	29	225	24	35
1937	173	145	36	354	56	57
1936	435	77	24	536	22	1
1935	30	60	7	97	15	27
1934	72	37	76	185	17	..
1933	17	25	..	42	7	..
1932	5	7	..	12	1	1
1931	62	21	91	174	28	2
1930	382	18	21	421	20	95
1929	1,055	80	95	1,230	106	77

Note:—The totals of domestic and U.S. export orders for years 1941-1944, *exclude U.S. Government purchases.* Domestic orders placed in 1941-1943 are adjusted to eliminate orders subsequently cancelled due to W.P.B. restrictions on building. In certain instances, domestic orders placed in December are not reported until following year; statistics for years 1929-1943 are adjusted to eliminate this overlap.

be increased. In addition to the excellent visibility already referred to, the cab has been thoroughly insulated for year-round comfort, and fan-blown hot water heaters are provided for winter operation. The short, rigid wheel base and swivel truck arrangement provides very comfortable riding qualities for the operator and, as Diesel handling is accomplished with very little physical exertion there is less fatigue. Coupled with the absence of smoke and steam which frequently obscures the operator's view from a steam locomotive, this makes for better signal observance and greater safety.

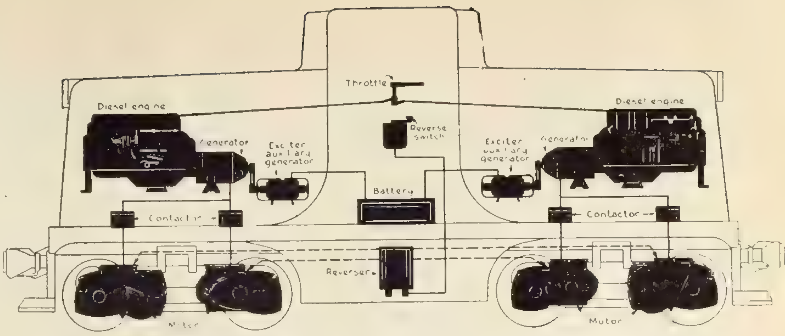


Fig. 1—Typical arrangement of electric drive in Diesel-electric locomotive for switching, branch line and industrial use.

A general idea of the purpose and relationship of the principal items in one of these two-engined locomotives is shown in Fig. 1. The most important of these are the variable speed internal combustion engine which burns fuel oil to develop power in its cylinders, and the electrical system which transmits that power to the driving wheels. The electrical generator is mounted on the end of the Diesel engine and driven by it. Excitation is provided by a small generator, belt-driven from the main unit. Electrical energy developed by the main generator is used in the traction motors which are geared to each of the driving axles and perform the actual duty of propelling the locomotive. The main generator is also used as a motor to start the engine, taking power for this purpose from the storage battery through specially provided cranking windings. The application of the electrical energy to the traction motors is regulated by the throttle and a motor reverser is used to establish the direction of movement.

Design Features

In general construction, gasoline and Diesel engines are almost identical. The gasoline engine draws in its fuel in the form of gas, the gasoline being vaporized and mixed with the proper quantity of air. This fuel mixture is then compressed and fired by an electric spark. The Diesel engine sucks in nothing but pure air, and, after this is compressed, the fuel is sprayed into the combustion chamber in a very fine vapour and fired by the heat generated when the air is compressed. The method of introducing the fuel is the fundamental difference between the two engines, and is responsible for the much higher thermal efficiency of the Diesel. In the gasoline engine the maximum compression of the gas fuel mixture must be low enough to guard against pre-ignition of the charge due to heat of compression; i.e., about 7 to 1. In the Diesel the compression pressures may be much higher—about 18 to 1—because only air is involved. The higher temperatures and pressures result in greater efficiencies. A well designed, solid injection engine will deliver a brake horsepower for .38 lb. of 18,600 B.t.u. fuel, and, since the horsepower is equivalent to 2,545 B.t.u., the theoretical thermal efficiency will be about 36 per cent. As applied to a Diesel locomotive, 33 per cent over the operating range is quite usual, which means 25 per cent at the wheel rim of the locomotive. This compares with about 15 per cent for a gasoline engine and 1.5 per cent for steam in switching service.

An internal combustion engine is designed with a definite maximum horsepower output, and the need for automatic limitation of the engine loading to that available was recognized early in its development for railroad motive power. Systems of controls which relied upon the engineman's judgment to utilize the engine's full output most effectively, without exceeding the engine's capabilities, were found to be unsatisfactory because they required too much skill on the part of the operator. This still applies to motive power with mechanical systems of transmission (change gears and clutches) where mishandling can easily place severe stresses on, and seriously increase the repair expense of, the engine and drive equipment. The success of the Diesel engine for modern railroad motive power has been due, to a great extent, to the application of automatic engine load-limiting characteristics built into the transmission system. Electrical drive has proved, so far, to be the most practical method of transmitting the power from a Diesel engine to the drive wheels of a locomotive. For this reason, it is the most generally employed.

In the design of a generator to be driven by a railway type Diesel engine where space is at a premium, every effort is exerted to limit its size. By adopting the principles used by the designers of railway motors, who are always faced with the space problem, it is possible to build very compact machines. Special effort is made to secure effective ventilation of windings and, in addition, a type of insulation is used which is capable of withstanding high temperatures. Creepage distances are carefully proportioned so that space is not unduly wasted. The voltages selected are such as will result in economical design and the iron losses, copper losses and friction losses reduced to a minimum.

In the layout of a complete transmission and control system for these locomotives it was first necessary to learn the characteristics of the particular Diesel engine to be used. Its full load and maximum speeds affect the size of the generator; its idling speed affects the system of control; and its torque characteristics may have a bearing on the scheme. With modern controls, the full engine load is maintained approximately constant during the time the engine is up to full speed. The windings in the exciter automatically allow the main generator field—and consequently the generator voltage (which corresponds to locomotive speed)—to increase when the current to the traction motors is reduced. By clever handling of the design in the control system, the generator characteristic is matched to the engine's performance, so that maximum results are obtained without danger of overloading.

Comparison of Operating Costs

Before enlarging on the use of the Diesel in switching service, let us take a brief glance at the record of steam power in freight work. There has been an increase of fully 50 per cent in freight train speeds between important terminals in this country during the last ten to fifteen years. Designing to suit the special conditions met in this service, together with the general adoption of superheaters, feedwater heaters, syphons, stokers, boosters, and a multitude of devices, has made this possible. A very substantial increase in efficiency and capacity has accompanied these improvements.

Table II

Comparative Steam Switcher and Diesel-electric Switcher Operating Costs per Hour of Locomotive Use

Item	*0-8-0 Steam Switcher*		*660 hp. Diesel*	*1,000 hp. Diesel*
Fuel (Coal 700 lbs. @ 3.50 ton)	1.21	(Oil 6c Gal.)	0.28	0.37
Water	0.03		....	....
Lubricating Oil	0.03		0.05	0.05
Enginehouse Expense	0.30		0.07	0.07
Supplies	0.02		0.02	0.02
Wages	1.65		1.63	1.63
Repairs	0.90 to 1.00		0.40 to 0.60	0.50 to 0.70
Totals	$4.14 to 4.24		$2.45 to 2.65	$2.64 to 2.84
Average savings per hr. with Diesels	.....		$1.64	$1.45

The fact that the steam switcher has changed so little might lead one to believe that it is a relatively efficient machine. Such is not the case, however, as it can boast of but one-third the efficiency of the modern reciprocating road locomotive. It appears that the varying load conditions of switching service are not easily satisfied by the direct-connected steam engine, as it obtains only 1.5 to 2 per cent of the heat units in the coal as useful work at the wheel rim. The Diesel engine, on the other hand, is well suited to this work.

Switching service, while not spectacular, is a very expensive item. On one large American road the total transportation yard expense is about 22 per cent of the total operating expense. Taking the fuel bill of Canadian roads as a guide. it appears to require about 25 per cent of the total. The intermittent nature of switching service, together with the wide fluctuation in load and idle time, presents no problem to the Diesel engine which can be readily started or stopped. When stopped, it of course uses no fuel. The steam switcher on the other hand uses considerable fuel when steaming up in preparation for work and while standing awaiting assignments. In railroad switching one tank car of Diesel fuel oil (8,000 gals.) will cover the same number of service hours as twelve 50-ton cars of coal. Country-wide reduction in hourly fuel expense by the use of Diesel switchers has averaged better than 75 per cent. The reduction in cars for fuel haulage, at the ratio of one for Diesel against twelve cars for steam, reduces the investment of the railroads in cars and their maintenance, and means much less non-revenue ton miles to move.

In Table II are given comparative operating and repair costs which are representative for an 0-8-0 steam switcher, 660 hp. Diesel and 1,000 hp. Diesel. The figures for steam and Diesel are taken from the railway accounts which are used to meet the United States Interstate Commerce Commission requirements. Operating and repair costs vary considerably both on steam and Diesel switchers. Also the individual items vary according to the size and rate at which the engine is worked. The costs of the steam switcher are average for a coal-fired locomotive operating in the eastern States. The firing rate of 700 lb. of coal at $3.50 per ton is conservative, and $5.00 per ton would more nearly represent Canadian conditions.

The operation and maintenance figures for the Diesels are average for groups of various types of locomotives operating on several railroads. Further studies involving groups which are all of identical and more modern design yield a repair cost of 21c and lubricants 3c. This produces an operating cost of $2.31 for the 1,000 hp. size. Under these conditions, savings of $1.80 to $2.00 per hour are not unusual. Over a period of time the savings in operating costs amount to an impressive figure. The higher first cost of the Diesels has to be reckoned with, but this is more than offset by the greater number of hours per year which is obtained. Judging from the rate at which they are being purchased, this would not now appear to be a serious detriment.

Advantages for Switching Work

In general, Diesel electric locomotives have high availability. Particularly is this true in the freight yard where there is work twenty-four hours a day. The crews change on the job and the engine works three shifts of eight hours each. The steam locomotive availability is lower due to the necessity for cleaning fires, fueling, watering, boiler washing, etc. At its best it is about three quarters that of the Diesel-electric. Insofar as servicing is concerned, Diesel switchers can stay out of the round-house almost continuously for a month at a time. This is due to the large quantity of fuel carried and the ease with which refueling operations can be performed. The daily and weekly inspections can, in many cases, be made without loss of time.

Diesel switching locomotive availability of 90 to 95 per cent is being obtained by groups of engines which have been in service for a number of years. In most instances this is an improvement over the figures obtained in the first few years. It would appear that, as early defects are corrected and the personnel becomes better acquainted with the equipment, higher availability can be expected.

Much of what has been said for the larger sized locomotives — 1,000 hp. and 660 hp. — also applies to the 380 hp. steeple cab types. These locomotives, which are 44 tons weight on drivers, are finding application in general switching, in light traffic and branch-line service. In addition to its lower first cost, reduced maintenance, and suitability for operation on lighter lines, this locomotive can be handled in many instances by a one-man crew, allowing additional savings. This size of locomotive is equipped with two 190 hp. Diesel en-

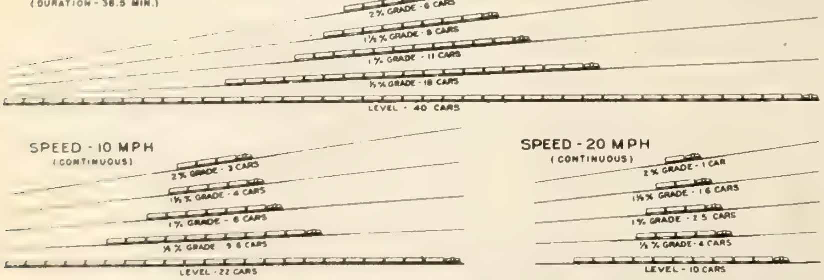


Fig. 2—G-E, 44-ton, 380-hp. Diesel-electric locomotive. Number of 50-ton cars it can haul.

Table III

Horsepower and Distribution of Domestic Diesel Locomotive Orders

	Railroads		Industries		Total	
Horsepower	*1944*	*1943*	*1944*	*1943*	*1944*	*1943*
6,000	6	3	..	..	6	3
5,400	39	70	..	..	39	70
4,050	8	..	..	..	8	..
4,000	22	38	..	..	22	38
2,700	8	..	..	..	8	..
2,000	78	22	..	..	78	22
1,350	18	..	..	..	18	..
1,000	334	342	..	11	334	353
660-600	57	31	23	6	80	37
Less than 600	26	30	51	82	77	112
Total	596	536	74	99	670	635

Note:—1943 totals are adjusted to eliminate orders subsequently cancelled in 1944 due to War Production Board limitations.

gines direct connected to railway type generators. Each of the four axles is driven by a high speed, light weight, high capacity motor, particularly designed for railroad service.

Other features which adapt this type and size of locomotive to conditions in many switching yards are moderate speed, heavy duty engines of four cycle types; simple control with the motors permanently connected in parallel; battery charging at all speeds including idling speed; multiple unit control for dual operation where required; provision for easy maintenance, and a sturdy, all-welded mechanical construction.

The complete engine-generator set is assembled as a unit and mounted on a three-point support, and requires no sub-base. Excitation for the generator field is supplied by an exciter of the split-pole type which is belt-driven from the generator shaft. Characteristics of this generator together with the exciter make possible the utilization of the maximum output of the engine over a wide range of locomotive speeds. It will be noted from the curves (Fig. 2) covering the various weights of trains on grades up to 2 per cent that this locomotive shows good acceleration at starting and low speeds.

Of the various sizes of Diesel-electrics which have been purchased by the railroads, the 1,000 hp. unit has become increasingly popular during the past two years. Reference to Table III shows that nearly 60 per cent have been of this size.

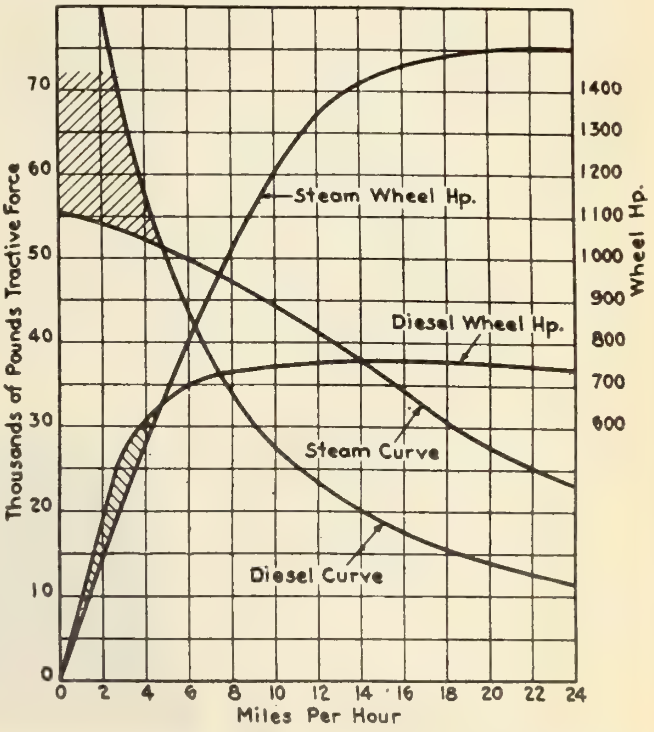
Increasing Use in Steel Industry

It will be noted from the above table that the industries are taking an active interest in the smaller size Diesel-electric. Over 75 per cent of the total purchases of locomotives during the last two years for industrial use have been under 600 hp.

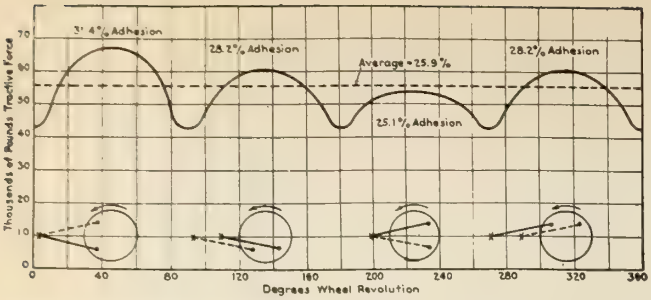
The steel industry was among the first to adopt the efficient time and labour-saving Diesel-electric locomotive for switching within its own property. It is an example of what is being accomplished in this line. The early locomotives sold at $200 per horsepower, but even at that figure they have proved to be a good investment and have paid for themselves several times over. The reason for the high cost was that the engines and electrical equipment revolved slowly compared to present day standards; a lot of material rotated and reciprocated to produce tractive effort at the drawbar. These units had a high degree of reliability, however, and the steel industry took hold of the Diesel-electric idea seriously. The development for years was largely along the lines of big units; steam was used for the lighter jobs because there were no suitable Diesel-electrics available.

In 1939, the small Diesel-electric appeared with high-speed engines and electric drive, first as a 20-ton, 150 hp., then 45- and 50-ton, 300 hp. locomotive, and at the astoundingly low price of $60 and $70 per horsepower. Again, with the same pioneering spirit of the '20s, the steel industry bought a few and tried them. To the amazement of many, these so-called "pinwheel" designs proved their worth. There were troubles, but ways were found to iron them out gradually, until today the small Diesel-electric has made a place for itself in this toughest of all industrial assignments—steel mill switching.

The term "small Diesel-electric" has come gradually to mean locomotives of 80 tons and under, as contrasted with units of 100 tons and over which were developed primarily for Class 1 railroad use. "Small" is perhaps an unfortunate adjective to apply to this class of motive power because to some it may imply locomotives relatively too fragile and impotent for the rigorous demands of steel mill work. The performance of these "small" Diesel-electrics in a score of steel plants during the present high-pressure, record-breaking period of production has proved beyond dispute that any such inference as to their potency does them a rank injustice. In sizes from 20 tons up to 80 tons including intermediate sizes, they have been doing excellent work.



Characteristic performance curves for a typical eight-wheel steam switcher and a 1,000-hp. Diesel-electric switcher.



Approximate variation in steam-locomotive torque during one wheel revolution under starting conditions at 85 per cent boiler pressure.

The high axle weights and concentrated loads of steel mill rolling stock result in most plants having heavy rail, adequately supported, be it by roadbed or bridge structure. Consequently such plants have been able to use heavy 2-axle locomotives successfully, instead of the 4-axle type, thereby getting an inherently simpler, stronger piece of motive power mechanically, and acquiring these advantages at a somewhat lower first cost.

In the light of the severe requirements of steel-mill work, perhaps the greatest tribute to the small Diesel-electric is the fact that, in many cases, standard industrial models have been successfully used. In other words, locomotive manufacturers have built such sturdiness into some of their standard designs that they are indeed universally applicable to industrial service.

Development for Passenger Service

The development of rail cars for light passenger service was mentioned in the early part of this paper as being the forerunner of the streamlined Diesel trains of today. The early efforts were chiefly concerned with low cost transportation and no particular attention was given to high speed or comfort. The majority of these small trains were driven by low horsepower engines and could only attain speeds of about 60 miles per hour. In the early part of 1934 it became apparent to many railway executives that it would be necessary to develop modern and comfortable high speed trains that could be economically operated and also attract much additional passenger business. By this time the Diesel had proved itself in switching service and some trains were placed in service powered with 600 hp. engines. There was not a large number of units employed up until 1938, but the installed horsepower per train increased to an average of 3,600 at that time.

In the United States in the year 1941, despite the shadow of impending war, there was widespread activity in streamlined trains; in all, about 30 of these were placed in service and a high percentage were on main line long distance runs.

Again referring to Table III, it will be noted that there was a very marked increase in the use of Diesel locomotives of 1,350 to 6,000 hp. which are the road types, and, in 1944, there was an increase of 28 per cent over 1933. At the present time these locomotives are operating about 50,000,000 miles per year in passenger service.

A Summary of the Advantages

A résumé of what has been accomplished by Diesel-electric locomotive operation in main line service is as follows:

1. The scheduled time for passenger service between important terminals has been reduced. There has been a steadily increasing number of high speed passenger trains placed in service by various railroads, all of which have proved to be popular with the travelling public. Incidentally, some railroads which inaugurated high speed service utilizing steam motive power initially, have since changed to Diesel power for this fast service.
2. In freight service it has been possible to increase the tonnage hauled and the average speed between terminals. The power performance, particularly in lower speed ranges has made it possible to operate trains over most ruling grades without the need of helpers or for double heading.
3. In bad weather with adverse rail conditions, the Diesel locomotive because of uniform torque on driving wheels and distribution of available tractive effort over a greater number of driving wheels, has demonstrated its ability to maintain schedules without reduction in the weight of train handled.
4. The Diesel locomotive has shown the possibility of long locomotive runs, 2,200 miles with very little service required at intermediate points. It has directed attention to the fact that the only economical operation is obtained from motive power that is moving. Indirectly, attention has been focused on terminal delays to freight trains and to the need for improvement in getting trains through divisional terminals.
5. It has stimulated the energies of steam locomotive designers to develop steam power that has performance characteristics to compete with those of the Diesel-electric locomotive.
6. A comparison of the overall thermal efficiency (ratio of power output at drawbar to heat content in fuel), shows the Diesel road locomotive to have an average thermal efficiency of 26 to 28 per cent, while comparable steam locomotives have a corresponding thermal efficiency of 6 to 8 per cent. Because of this, there is a two-fold advantage for the Diesel locomotive in that there is a reduction in the amount of fuel necessary to carry and an increase in the length of operation between refueling.

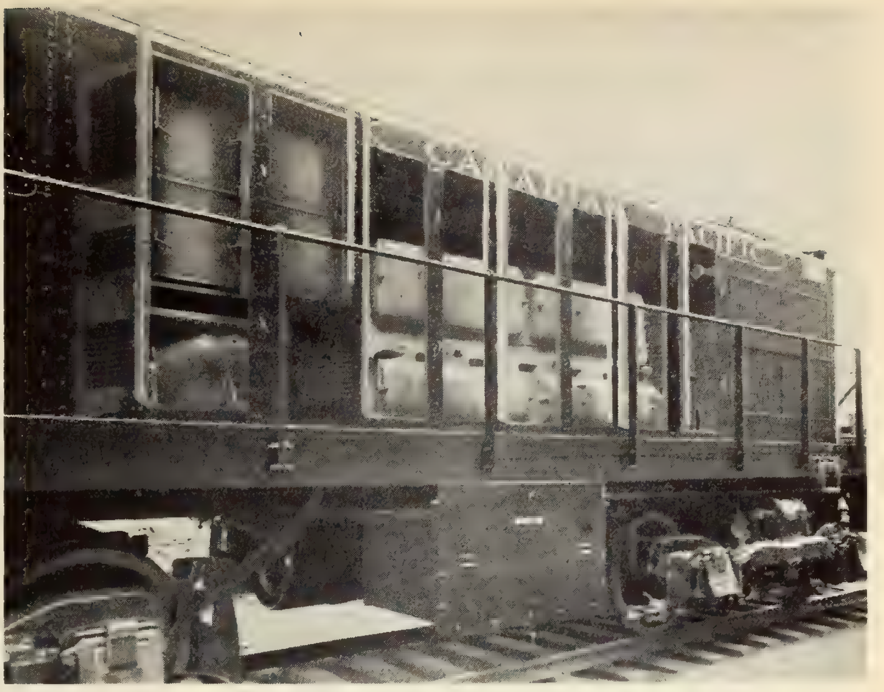
As in the earlier work space and weight limitations have again caught up to us in these larger locomotives. Increased horsepower is now being obtained by the use of two, three and four cab locomotives in order to spread the units over a greater length of rail and utilize existing designs of trucks. The use of several units undoubtedly has increased the price over what would be possible if the whole of the motive power could be contained in one unit. There is also a further disadvantage in handling a number of units: the length of the locomotive does not permit going in any ordinary

1,000 hp. Alco-G.E. Diesel-electric switching locomotive, 115 tons weight on drivers, 69,000 lbs. starting tractive effort.

round houses or running sheds. The transportation industry, however, has always been in the forefront with development tending toward concentration of capacity, and research now underway is directed towards the use of 6,000 hp. all in one cab.

Conclusion

We have now discussed the rapid development of the Diesel-electric road locomotive, its advantages, and disadvantages, and have commented on some of its development. To give practical point to this and to relate it to an actual application of this type of motive power on an important railroad, I have drawn on recent data on the Rock Island Railroad System, which has been published in the magazine "Fortune".



Interior view of locomotive shown in previous figure.

> "The company also spent $20 million on bigger and better engines—ten heavy 4-8-4 steamers, nineteen Diesel passenger engines, eighty-two Diesel switchers, and nine 5,400-horse power Diesel freight engines. Their prime advantages, of course, is high availability. Diesel passenger engines run as high as 1,080 miles per day, Diesel freight engines are averaging 400 and more, and switchers operate practically continuously. Moreover, Diesel's advantage of high starting power is proving out especially well in freight service; and although Diesel passenger engines lack power in the high-speed ranges when an extra car is added to the train, their ability to take curves ten miles an hour faster than steamers and their lack of track pound have made them nearly indispensable for fast passenger service. Dieselization—and stepped-up use of steamers—has enabled the railroad to eliminate heavy repair shops at Des Moines; Trenton, Missouri; Horton, Kansas; and Shawnee, Oklahoma; and to concentrate heavy repairs in the main shops at Silvis, Illinois. Small repair shops had to be installed in division roundhouses, but even so the shift is saving an estimated $700,000 a year."

This description of a proved application of Diesel-electric motive power in passenger, freight and switching services, is typical of many others and attests to the popularity of this type of railway motive power. This article also points out that by working steam freight locomotives more intensely the average has been raised to 270 miles per day. This is a direct comparison with the 400 or more miles per day averaged by the Diesel-electric freight locomotives.

Intensive utilization of Diesel-electrics means 24 hours a day in switching or 300,000 miles per year with road locomotives. The unit construction of the Diesel-electric is an advantage in maintaining these high figures over a period of time. By interchanging engine generator sets, traction motors and trucks the necessity of locomotives being tied up extensively is avoided. This also permits the power units to be repaired under more favourable conditions than when on the locomotive and results in the use of factory methods and tests and improved performances.

In conclusion, it would be far-fetched to intimate that the Diesel locomotives will displace steam locomotives altogether in railroad service, but they are definitely a part of the picture and as more and more of them are built, there undoubtedly should be a further decrease in the unit cost. This will narrow the gap now existing in the relative initial investment of the Diesel-electric versus steam locomotive.

As for switching in industrial plants, there is, in general, no other form of motive power which is so flexible as the Diesel-electric or which can handle the job with such a high degree of availability and at the same time has such low maintenance and overall costs.

POLLUTION HAZARDS IN A WATER SUPPLY SYSTEM

With Particular Reference to City of Montreal's Experience

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Paper presented before the Montreal Branch of The Engineering Institute of Canada on March 15th, 1945.

Life is a perpetual struggle of the organism with its environment, and death marks its final and unconditional surrender. Doubtless the principal cause of death should be old age, the natural maturity of the organism. Unfortunately, this is not so, and we experience premature deaths, the cause of which could be divided into two classes: one constitutional, arising within the body, and the other, environmental, arising outside the body.

The duty of the Division of Sanitation, (one of the several divisions of the Department of Health of the City of Montreal), like that of all public health organizations, is to fight the cause of diseases responsible for premature deaths and for the lowering of the vital resistance of the human body.

Among these diseases, there is one important group, known as water-borne diseases, many of which can be easily prevented and are constantly fought by public health and sanitary engineers.

As water is one of the three essentials of human existence, coming only after air, it is very important that all premises intended for human habitation or occupancy should be provided with a supply of pure and wholesome water, if we desire to safeguard and promote the health of the community.

What makes this more difficult is the impossibility to judge the quality of water by its appearance. While appearing bright and attractive to the eyes and to the taste, it may contain millions of disease germs.

The water supplied by a municipality may be of the best quality after treatment, but yet it may change materially in character in the distribution system throughout the city, and become polluted before it reaches the consumer's tap. In 1932, a by-law was passed by the Montreal City Council, in order to prevent pollution of the city's water supply.

The following study of the dangers of pollution will deal only with buildings and not with possible contamination of potable water on transports such as boats, trains, etc., these latter being controlled by the Federal Department of Pensions and National Health.

There are three kinds of possible pollution of the water supply in the city:—

1—The city of Montreal's water service with its own dangers of pollution.

2—Danger caused by cross-connections between the city water supply and any auxiliary source of water, as the St. Lawrence river, the Lachine canal, the Des Prairies river, or any well within the city,

3—Danger of pollution in buildings where there is only the municipal water supply.

Municipal Water Supply

The city of Montreal obtains its supply of water from the St. Lawrence river, the quality of which varies according to the relative conditions of the St. Lawrence and the Ottawa river waters. The water goes through a sedimentation period of more than two days in an open canal six miles long, before it is filtered and sterilized with liquid chlorine. At this

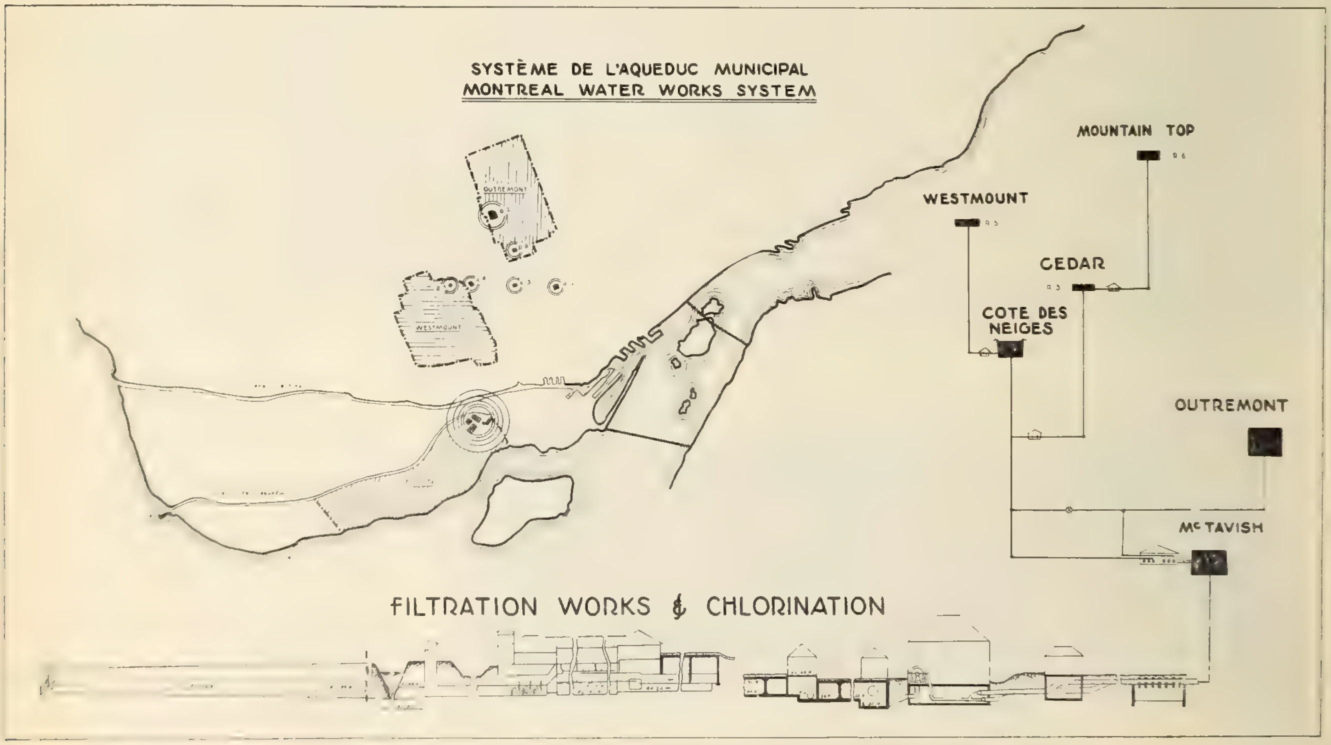


Diagram showing general layout of Montreal's water supply system.

point the water is stored a few hours in an underground reservoir.

The process of purification at the filtration plant comes under the Public Works Department, where a staff of competent bacteriologists and chemists ascertain that the water that leaves the filtration plant is pure and free from bacteria.

The effectiveness of such purification of water is shown by the reduction in the death rate from typhoid fever since the first installation was made in Montreal. In 1876, this death rate was 83.9 per 100,000 population, in 1909 it dropped to 50, while in 1944 it was as low as 0.9 per 100,000 inhabitants.

From the filtration plant, the water is pumped directly to low level areas of the city and to different reservoirs for the high level areas. An open reservoir, the McTavish, located south of the Royal Victoria Hospital on Pine Avenue West, supplies the Outremont reservoir, corner of Bellingham and Mount Royal Boulevard, and the Cote des Neiges reservoir, corner of Belvedere Road and Cote des Neiges Road. It also supplies the Cedar Avenue and the mountain top reservoirs, and a steel tank in the city of Westmount. All except the Cote des Neiges reservoir are open to atmospheric pollution, which causes some seasonal variation of B. Coli in the city water.

The maximum pollution due to B. Coli occurs in summer, with practically none in winter when there is a layer of ice to protect the water. This pollution of course depends on the temperature and wind velocity. On September 14, 15 and 16, 1939, with excessive heat and wind velocity of 25 miles per hour, we registered an abnormally increased amount of B. Coli in the water that had fortunately no apparent effect on the health of the population. The particles of dust and dirt washed out of the air into the reservoirs did not bring any infection. Nevertheless with open reservoirs there always exists a possibility of contamination, either from growth of algae, micro-organisms, protozoa, fungi and water animals, bacteria, and organic matter either of fecal origin, from animals, or of non-fecal origin, from decaying plants, leaves, etc.

The presence of B. Coli is used as an index of pollution, because it is this group of bacteria which is present in the feces of man and animals and constitutes an excellent indicator of other possible pollution of a dangerous character. Potable waters rarely contain more than 1 to 2 B. Coli per 100 c.c.

The Department of Health of the City of Montreal, in cooperation with the Provincial Department of Health and with the municipal Public Works Department, maintains constant supervision to ascertain that the drinking water reaches the consumers free from any pollution. For that purpose, samples of water are taken every day throughout the city. All the open reservoirs are emptied and cleaned at least once a year.

Another operation that might cause the contamination of a water supply, is the replacement or repairs of water mains in streets. To avoid this, all new pipes are disinfected by the employees of the water works division.

Cross-connections with Auxiliary Sources of Water

When the safe potable water supplied by the city reaches any building, there is a possible pollution hazard. This occurs in buildings supplied by an auxiliary source of water such as the St. Lawrence and the Des Prairies rivers, the Lachine canal or any well

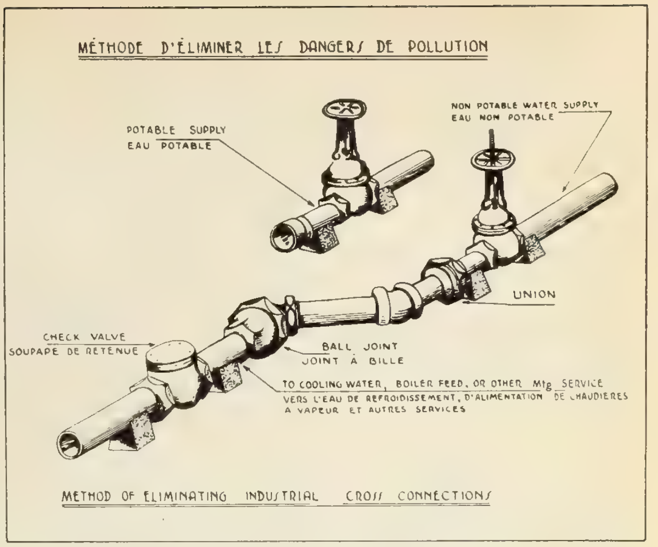


Diagram showing one method of eliminating industrial cross-connections.

located in the city, where there are cross-connections, which may permit a potable water supply to be directly polluted by non-potable water.

This question has become a matter of increasing importance during the past few years, as is evident by the space given to it in the medical and engineering journals. Everyone recognizes that the existence of cross-connections between public water supplies and any other source, unless both waters are of safe sanitary quality, is a serious menace to public health. Epidemics of water-borne diseases have, in many cases, been definitely traced to such cross-connections.

The most serious source of this kind of pollution is the common practice of many industries to use polluted factory supplies for fire protection and industrial purposes. The city water being too costly for these uses, an auxiliary source is often cross-connected through ordinary check valves to the public system. Should these valves leak with pressure higher in the private water supply than in the city mains, the polluted water will flow into the city pipes. Even with equal or lower pressure on the building side, should there be a suction in the aqueduct, the same result will be obtained, and every building supplied by the same water service pipe will receive polluted water. These cross-connections are generally found on fire service at the sprinklers and the water hydrants, at pump priming and where drinking water is taken off sprinkler systems on yard mains. In industries, they are used for boiler feed, washing processes, cooling, condensers, quenching, etc.

Several cities in the United States have experienced typhoid fever outbreaks, caused by contamination of drinking water through cross-connections. From this cause New Jersey had 114 cases of typhoid fever in 1929; Fort Wayne, Ind., 43 cases of typhoid fever caused by polluted river water entering the water supply; Albany, N.Y., 1927, an epidemic of diarrhœa followed by 30 cases of typhoid fever caused by three cross-connections in an industry where the pressure was in excess of the city pressure; Cohoes, N.Y., 47 cases of typhoid fever from cross-connection with an industrial supply. Pressure in city pipes went down five times prior to the outbreak.

A more interesting experience however, is the following one published in *Health News*, dated March 4, 1940, of the New York State Department of Health.

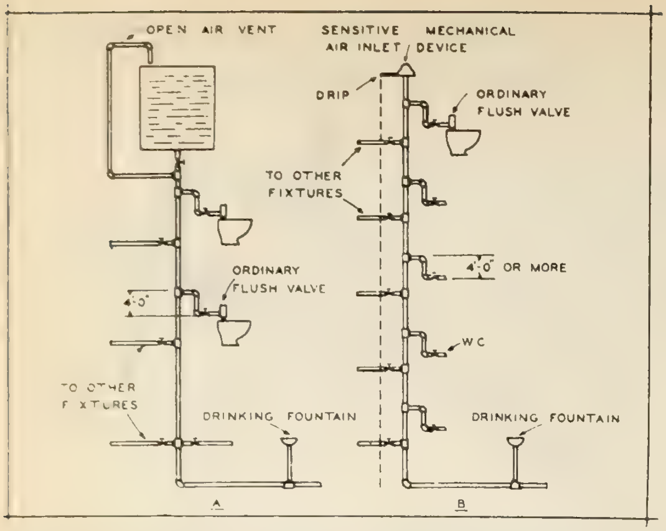


Diagram illustrating recommended plumbing connections with vacuum breaker on water distribution line. A—with reservoir; B—without reservoir.

A contractor was engaged in laying a pavement on a highway between Cleveland, Mississippi, and the town of Boyle. To supply water for the concrete mixer and the curing process, a pipe line was run between the two towns. At one end a connection was made to a fire hydrant in Cleveland, and at the other end to a stream highly polluted with sewage from the two cities. A pump was used to force the water into the pipe from the Boyle end, while at the other end there was the Cleveland city pressure. In the line there were several connections to which were attached, at times, a hose for supplying water to the mixer and for wetting down the pavement.

As the work progressed southward from Cleveland, it came to a point where the pressure from the city main was insufficient. The force pump was then put into operation at Boyle to supply the required pressure, making therefore a direct cross-connection between the Cleveland aqueduct and the polluted stream. One night, the pump at Boyle ran all night and increased the pressure in the line to 125 pounds, while the pressure at Cleveland did not exceed 40 pounds. Under such conditions water from the stream was discharged into the city main at Cleveland by the force pump at Boyle.

The result was that 157 out of 366 people in the area surrounding the fire hydrant were ill from gastroenteritis induced by polluted water. The Supreme Court of the state held the road contractor responsible and confirmed an award of $3,000 to cover damage for injuries resulting from the pollution of the public water supply of Cleveland by a dangerous cross-connection.

Control of Cross-Connections

Good progress has been made during recent years in the elimination and control of cross-connections and much valuable experience has been obtained. In some instances, the abolition of cross-connections presents a very serious problem, from the standpoint of possible loss of life and property by fire, and could not be done without disorganization of the industry. Insurance companies are quite insistent that industrial plants be provided with two sources of water supply for fire protection.

Nevertheless, complete physical severance between water supply and polluted auxiliary supplies is the only positive means of preventing such pollution of the public water supply. No cross-connection should be established or maintained between the public water supply or any other supply, unless both supplies are safe at all times and free from possible contamination.

In the city of Montreal, it is forbidden to make any cross-connection with the municipal aqueduct. The use of elevated or underground tanks open to atmospheric pressure is the only means permitted in new installations; they are so arranged that the city water pipe enters the tank at a point above the overflow line.

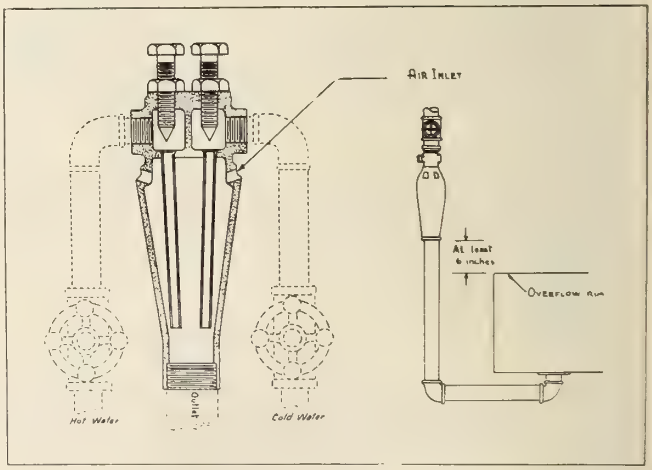
In existing installations, where it was impossible to install such tanks, cross-connections were tolerated, provided they were protected against possible back flow of polluted water.

The protection required was the installation, between the two sources of water, of two standard outside screw and yoke (O.S. & Y.) gate valves and two all-bronze special type, rubber-seated swing check valves; these valves being separated by a filler piece. The clapper or flap of the swing check had a special dome-shaped compressible live rubber facing, seating on a renewable bronze seat ring and tested to 300 pounds pressure. These check valves were provided with pressure gauges, test cocks and valves to permit checking the tightness of each valve in a few minutes.

The gate valve was of iron body composition mounted with a bronze spindle and also tested to 300 pounds water pressure. These valves were connected in series located in a pit accessible at all times and equipped with drains.

The success obtained with such a system of valves depends on how well they are inspected and maintained; no automatic device, can be relied upon for absolutely perfect working at all times. At any time, unknown to factory officials, a careless workman may make a connection inside the building, which will serve to by-pass the polluted water, around the check valve and into the city system. Pipe moss may also get under the clapper of the valve and keep it open.

These check valves should be inspected and tested at least monthly and taken apart at least yearly, for thorough cleaning and replacement of any worn part. Inasmuch as the usual method of testing the check valves is by pressure gauges, experience has shown that even if no leakage was registered by these gauges, there might be actual leakage, because the gauges were not sensitive enough to detect a small back flow of water.



Section through Boosey type vacuum breaker.

Experience has shaken our faith in the ability of this device to afford the necessary protection. Although it is an improvement over the single check valve or the ordinary double check valve, the protection afforded is not absolute or positive.

A simple and inexpensive method of eliminating industrial cross-connections is by means of a flexible pipe connection. In case of emergency this flexible pipe can be disconnected and swung over for connection to an auxiliary source. The inlet end is connected by a union to either the normal or emergency water supply system, and the discharge end is connected by a standard ball joint to the distribution piping of the mill. This swing joint, however, is not suitable for the elimination of fire service cross-connection.

McTavish Reservoir; capacity 45,000,000 gallons.

Any other arrangement whereby a cross-connection is discontinued by removing a flanged elbow on a pump discharge, or a filler piece, is dangerous, if there is a possibility that the unprotected cross-connection would be re-established in case of emergency.

Danger of Pollution Through Faulty Plumbing

In some buildings which are supplied only by the municipal aqueduct, safe water is reclaimed after being used for industrial purposes, and may become polluted or connected directly with sewers through plumbing fixtures. This constitutes another hazard of local pollution of the city water which must be considered.

The danger is the possible contamination of the city water through back siphonage from plumbing fixtures, tanks, or any receptacle holding waste water sewage. As plumbing fixtures in a building are the terminals of the water supply system and at the same time the beginning of the sewerage system, the sewage may under certain circumstances return into the water supply pipes.

At certain times, the public water service is interrupted for ordinary repairs and changes to street mains, thus causing fluctuation in pressure in the water distribution system in buildings. Other causes of variation of pressure in pipe lines, are excessive demand during fires, the closing of main line valves, or the stoppage of pumps. It may also be caused by faulty plumbing arrangements and improperly designed plumbing fixtures. Siphonic action, or the reversal of pressure head, may also cause danger of pollution.

In tall buildings, pressure variations are more liable to occur on account of the height of the building. When a partial vacuum is formed in a water supply line, unless it is relieved by entry of air, any open path, or connection, for the passage of polluted water into the line provides the condition necessary for contamination.

Some dangers of pollution are very apparent, others are less evident, but there are so many possible kinds of contamination that it is difficult to understand why we do not have more cases of water-borne diseases than we do.

There is not space to describe here all the different dangers of pollution existing in buildings. Some of the more important ones may be mentioned, however. For instance any plumbing fixture, either a bath, a kitchen sink, a wash-basin or a laundry-tub, where the inlet is below the overflow line, is dangerous. W.c. bowls equipped with flushometers, bed pan washers and industrial vats, with inlet at the bottom present the same danger. Therapeutic baths and hospital fixtures may also be causes of pollution. Submerged inlets to sterilizers, direct connections from cooling coils to the waste pipes, by-passes around sterilizing apparatus and a hose attached to a faucet and allowed to hang in a tank, have been found to menace the safety of the drinking water supply, and of the sterilizer water supply as well.

The same experience has been found with condenser water, used in shell and tube condensers, in which there is a single wall of metal that separates the refrigerant from the water supply.

A complaint was received one day, that on the third floor of a building, the occupant was collecting ammonia at the water tap of his dwelling. The inquiry revealed that on the ground floor of that building ammonia was used for cooling purposes and that a flow in the tube had permitted ammonia to flow into the city water pipe.

Hydraulic elevators, lift presses, ejectors, direct connections to sewers, city water pipes connected with tanks or reservoirs filled with chemicals, water sprays and air-conditioned equipment, overflow from reservoirs connected directly to sewers, cellar drainers, etc., may also contaminate the potable water service.

In practically all recirculating types of swimming pool, there is danger of pollution, between the city water and the pool water. The drain also presents a danger, if there is a direct connection with the filter-wash water waste. During a fire, a swimming pool was emptied down to the inlet pipe level in the pool by fire pumps which were connected to the city water supply. Any resident between the pool and the fire, who opened his water tap at the same time, was drinking swimming pool water.

A valve pit in the yard of a factory, protected with manure for the winter, had two feet of water at the bottom. The result was that the city water in the vicinity of this factory tasted of manure. A gardener, using a greenhouse spray system for watering his plants, closed the gate valve on the public supply main, pumped liquid manure into the spray line and discharged it into his beds. No wonder the neighbours also complained that their drinking water tasted of manure.

In another case, the propeller of a water meter was ruined by acid. This acid was certainly not brought by the aqueduct but by a negative head in the supply line. Sudden disappearance of a solution in a photographic vat fed with city water was caused by a sudden drop in pressure in the supply pipe.

In Michigan State College in 1939, bacteria infested water was siphoned from a laboratory to other parts of a building, causing an outbreak of undulant fever among 40 persons. This was made possible by a decrease of 75 per cent in pressure in the distribution service, causing a suction in the pipes.

An epidemic of amœbic dysentery had its origin in Chicago during the summer and fall of 1933. Two large downtown hotels were involved, their sewers were overloaded to an unusual degree during this period, as it was the year of the Century of Progress Exhibition and there was at the same time excessive rainfall.

The major points of possible pollution were that, in one hotel, an overhead sewer was joined to a condenser water discharge pipe; this water, after being used for cooling purposes, was redistributed throughout the two hotels. An old rotten wooden plug, in an overhead sewer, also permitted leakage of sewage into the cooled drinking water tank below.

The booster pump and air lift of a deep well were placed in a concrete pit below street level. The pit had a drain connected to the sewer. A rain storm filled the pit with sewage, backing up so that a leak in the casing permitted infection of the well water, causing an epidemic.

Infected water may be siphoned from a sterilizer. This was also experienced in Chicago. It was the practice to sterilize instruments by boiling them in water contained in a sterilizer whose city water supply was admitted through a connection made into the bottom. This water was heated by a steam coil, but there was nothing to guarantee that a boiling temperature would be reached before the instruments were placed in the water. If therefore infected instruments were placed in the sterilizer while the water was cool and the inlet valve opened or leaking, a vacuum in the supply line would easily siphon infected water from the sterilizer. Such a vacuum was actually produced by closing a valve on the main supply pipe, as might be done at any time for making repairs. It might also occur by simultaneously opening a number of faucets on a lower floor.

In 1943, in Chelan county, Washington, cross-connections between a water main and sewerage systems through a refrigerator machine had been found to be the cause of infection of the water supply.

Safe Plumbing Layout

The best way to prevent these possible dangers of pollution is to admit air into the supply line, so as to break the partial vacuum; special vacuum breakers have been designed to overcome any suction that may tend to form there.

If faucets with open spouts, discharging over plumbing fixtures, are provided with an air break between the water supply and the waste pipe, self-protection exists against possible pollution.

Flush valves should also be provided with effective anti-siphonage devices and all submerged water inlets to plumbing fixtures should be removed, as they constitute a potential hazard.

Moreover, sewers or drains should never pass over water tanks, or any place where water, ice or food are prepared, handled or stored; water storage tanks should at the time, be effectively covered.

Whenever pumps are provided to repump water within a building, ample provision should be made to prevent a negative head on the water supply system, when the pumps are being operated. Overflow lines can be safely protected by discharging through an air gap into a surface drain.

Conclusion

After having noted those pollution hazards, it is evident that no plumbing fixture or device should be installed in such a way as to provide a cross-connection or a danger of pollution between a city distribution system of water for drinking and domestic purposes, and any auxiliary source of water or a drainage system that will permit or make possible the back flow of non-potable water or of sewage into the water supply system.

Moreover, no sanitary fountain, sink, or wash-basin should ever be connected to a secondary source of water of unsafe quality.

Unprotected cross-connections between polluted private supplies and potable public water supplies are a menace to public health. Even a very small amount of water, siphoned into the water supply pipes from fixtures may be just as disastrous in its results as if many gallons of water were drawn in.

Every plumbing installation requires competent design, careful operation and regular inspection by experienced and trained personnel, so that safe water supply, proper sewage removal and general sanitation will promote the health of the population.

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THE ATOMIC BOMB AND CANADA'S CONTRIBUTION TO IT
Uranium Fission Plant

The biggest news of the war was the announcement that atomic energy had been harnessed and used in the form of a bomb. The news had significance far beyond the field of war, and now that the war is over attention is being concentrated on the alternative uses.

Coincident with the announcement of the bomb, a very full broadside of publicity appeared in publications all over the world. The Hon. C .D. Howe, HON. M.E.I.C., issued a very comprehensive statement of Canada's part in the project, including the news that a plant was being built in Canada for the production of an explosive constituent of the bomb. *The Engineering Journal* has been fortunate in securing an excellent and authoritative account of this activity which it presents herewith.

Canada's part in this new development will be of special interest to engineers. The plant combines the work of the physicist and the engineer so closely that at times it is impossible to determine where one leaves off and the other begins. All processes and equipment are so new that the design of equipment had to parallel to determination of processes. Out of this new field doubtless will come many new and perhaps revolutionary ideas with regard to mechanical engineering and metallurgy, from which engineers will surely profit, and industry benefit.

Canada's Uranium Fission Plant

The plant, situated on the south bank of the Ottawa river near Petawawa on a 10,000 acre site expropriated for the purpose, is now nearing completion. It will produce plutonium, the fissile material used as a nuclear explosive in one of the bombs dropped on Japan. It will also produce large quantities of radio-active materials that are expected to have wide application in medicine and in research, and it will provide a powerful source of neutron rays for research on atomic physics and on the application of atomic energy to new purposes.

The construction of the plant followed an agreement in April 1944 of the Combined Policy Committee representing the United Kingdom, the United States and Canada. This Committee, under the distinguished chairmanship of Mr. Stimson, United States Secretary of War, and with Canada represented by Mr. Howe, was created as a result of a discussion between the partner governments at the Quebec Conference in 1943, to bring research work directed towards the atomic bomb in Great Britain and Canada into the closest co-operation with the tremendous undertaking in the United States. The Committee agreed that a pilot plant for the production of plutonium by the method involving the use of uranium metal and heavy water should be constructed in Canada, while the United States should concentrate on two other methods of producing fissile material which were at that time in a more advanced stage of development, the production of plutonium by the uranium-graphite method, and the separation of U235 from natural uranium. It was considered desirable to push forward all three methods, because unforeseen difficulties might be encountered in any one of them.

This plant, which is so different from anything previous in industrial and technological experience, presented new problems of design that inevitably arose with the attempt to deal with the phenomena of nuclear atomic physics on an industrial scale. Uncommon materials were used to meet special needs, and common materials were used under conditions outside the scope of handbook information. The choice of materials and the design were dictated not only by the usual properties such as mechanical strength and resistance to heat and corrosion, but, even to a greater extent, by atomic properties which heretofore had been the concern only of academic physicists.

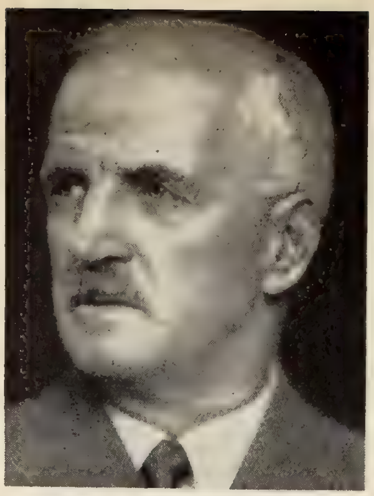
The fundamental design of the plant has been the work of the Montreal Laboratory of the National Research Conucil. This laboratory was set up in Canada in 1942 for uranium research and is staffed by a combined group of scientists from the United Kingdom and Canada, and includes some from France assigned by the Free French authorities to collaborate with the British scientists. The Laboratory is administered by the National Research Council under its president, Dr. C. J. Mackenzie, M.E.I.C., and directed by Prof. J. D. Cockcroft, Jacksonian Professor of Natural Philosophy, Cambridge University, England, with Dr. E. W. R. Steacie of Ottawa as Deputy Director. Its staff has now grown to over 400 and it has been

(National Film Board Photo)

The Petawawa pilot plant, on the Ottawa river, for the production of plutonium, the fissile material used for the release of atomic energy.

(National Film Board Photo)

Dr. J. D. Cockroft is director of the Montreal Laboratory of the National Research Council which is engaged on atomic energy research. Dr. Cockroft is Jacksonian Professor of Natural Philosophy in Cambridge University, England, and a Fellow of St. John's College, Cambridge.



Dr. C. J. Mackenzie, M.E.I.C., president of the National Research Council.

(National Film Board Photo)

Dr. E. W. R. Steacie is the Deputy Director of the Montreal Laboratory of the National Research Council where the experimental and development work on atomic energy is centralized in Canada.

described as the largest organization ever created in this country to carry out a single research programme.

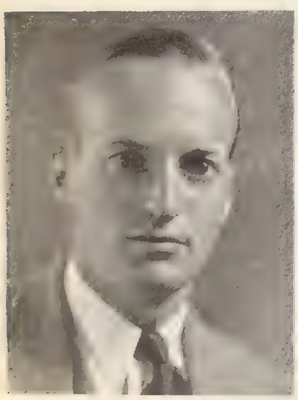
The erection and operation of the plant have been entrusted by the Department of Munitions and Supply to the crown company, Defence Industries Limited. Broad policy in design and operating procedure is decided on behalf of the Government by a Committee of Management under the chairmanship of H. Greville Smith, Vice-President and General Manager of Defence Industries Limited, which includes A. B. McEwen, M.E.I.C., Manager of Special Projects of Defence Industries Limited and H. J. Desbarats, Works Manager of Petawawa plant. The National Research Council is represented on the committee by Dr. Mackenzie, Dr. Cockcroft, Dr. Steacie and R. E. Newell, Head of the Division of Engineering in the Montreal Laboratory. The Department of Munitions and Supply is represented by A. N. Budden, M.E.I.C., succeeding B. K. Boulton, M.E.I.C., who recently retired to become President of Wartime Housing Limited.

Construction of the plant and laboratories, and the village for habitation of the staff, is under contract to Fraser Brace Limited of Montreal.

Plant Design Complicated by Nuclear Physics Considerations

Many details of the design of the Petawawa plant are still secret. This is true particularly of methods of process, choice of materials, quantitative data and physical dimensions. Some general information, however, which can be readily guessed by physicists throughout the world has been revealed.

The release of atomic energy on a large scale depends on a chain reaction in which the bursting (called "fission") of one uranium atom sets off the next so that, eventually, enormous numbers of the atoms undergo fission, the fission of each atom making its contribution to the total release of energy. The link pin between two atoms in the chain is a neutron, expelled from the first atom when it bursts, hitting and entering the second atom and bursting it. These neutrons, tiny bits of matter, actually fragments of atoms, play the essential role in the reaction. If, on their journey between uranium atoms, too many stray or are waylaid by capture in inert atoms of other materials, thus breaking the chains, the reaction is quenched. The explosion of the atomic bomb is made possible by the release of more neutrons in the fission of the uranium atoms than are absorbed, thereby multiplying the chains so that the intensity of the reaction builds up with explosive violence. In the Petawawa plant the absorption and release of neutrons will be carefully balanced to maintain operation at a steady power level. Adjustable rods of neutron absorbing



(National Film Board Photo)

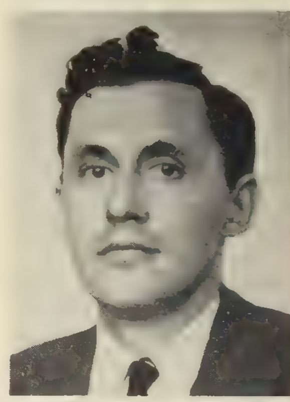
Dr. G. C. Laurence is head of the Technical Physics Division of the Montreal Laboratory which is engaged on atomic energy research. He initiated the research in this field in the National Research Laboratories in Ottawa in 1940.

(National Film Board Photo)

Prof. P. A. Paneth, of Durham University, England, who as head of the Chemistry Division of the Montreal Laboratory of the National Research Council, has investigated various methods of extracting plutonium and radioactive by-products which will be produced at the Petawawa plant.

(National Film Board Photo)

Prof. B. W. Sargent, Professor of Physics at Queen's University, whose services have been loaned to the Montreal Laboratory of the National Research Council where he is the head of the Nuclear Physics Division. This Division measured the various atomic constants required in the design of the Petawawa plant.



(National Film Board Photo)

Prof. G. M. Volkoff, head of the Theoretical Physics Division which has solved difficult mathematical problems arising in the design of the Petawawa plant. Prof. Volkoff's services have been loaned to the Research Council by the University of British Columbia.

material will provide this means of control. The balance of neutron release and absorption governs the size and shape of the reaction vessels, its parts and components, and the choice of materials used in its construction. Decisions on these details were based on laboratory measurements of neutron absorption and penetration in different materials and involved difficult mathematical analyses.

The production of the fissile material, plutonium, is brought about by the effect on the uranium in the reacting vessel of the intense neutron radiation. The neutrons convert the U238, which is the principal constituent of uranium, into plutonium. The neutrons for this purpose are produced by the fission of the U235, the rarer constituent in the uranium. The uranium is later removed to a chemical extraction plant and dissolved, and the plutonium and radio-active fission by-products are separated from the solution by chemical methods.

R. E. Newell, formerly of Imperial Chemical Industries Ltd., England, now attached to the Montreal Laboratory of the National Research Council where, as head of the Engineering Division, he has been responsible for the basic design of the Petawawa plant.

(National Film Board Photo)

All materials absorb neutrons, some to a greater extent than others. Those which absorb them rapidly had to be avoided in the design of the reaction vessel for their presence would prevent a sustained chain reaction. This precluded the use of such ordinary structural materials as steel, brass and bronze. Aluminum, less absorbent of neutrons, is used wherever possible with the minimum thickness and bulk needed to meet mechanical requirements.

The dissipation of the heat energy released by the reaction presents particularly difficult problems and was the subject of an important part of the laboratory's research programme. Ordinary water is unfortunately a bad neutron absorber and must therefore be used sparingly in cooling the reacting material. For this reason it is forced at velocities much greater than normal practice through very narrow channels. Since the tubing of these channels is aluminum, the high surface temperatures at which aluminum corrodes rapidly must be avoided.

The intense emission of neutrons produced by the reaction causes important changes in the materials they encounter. Almost everything becomes radio-active under exposure to the particles, emitting radiation which is destructive to human body tissues. For this reason the reacting vessel must be surrounded by barriers of concrete and other materials many feet in thickness for the protection of the operating and laboratory staff. Once the plant has been in operation these barriers cannot be removed and the reacting vessel which they enclose is permanently inaccessible and cannot be replaced or repaired. Plutonium and radio-active products of the reaction must be withdrawn into massive protective enclosures in which they are carried to the extraction chemical treatment plant where all the processes are controlled remotely beyond concrete barriers.

Even the cooling water effluent from the plant will be slightly radio-active. Fortunately its important radio-active constituent loses its activity fairly quickly. By delaying the water in a storage tank before drainage to the river, it is made completely harmless.

Another feature of the plant is the use of instruments actuated by the radiation. These are of many types but their common feature is an ionization chamber in which the enclosed gas is rendered electrically conductive by the ionization produced by the radiation. It passes a small current, sometimes less than 10^{-10} amps. proportional to the radiation intensity. In some cases the current is measured by a galvanometer, in other cases is amplified by electronic circuits to indicate on a more rugged type of panel instrument, or to operate relays interlocked in protective circuits for preventing control failures, to register on recorders, or to operate alarms for warning the employees of unhealthy radiation intensity. Thus there is added to the many meters, recorders, gauges and other control instruments familiar to industrial plants, a large number of others that depend on the measurement of radiation. The development of these special instruments for the plant was part of the work of the Montreal Laboratory.

Applications of Atomic Energy

The large scale release of atomic energy has led to the general speculation about its possibilities as a source of power. The Petawawa plant, referred to as a pilot plant, will nevertheless release energy at a rate comparable to a small hydro-electric development. This power, at present regarded as a useless by-product and a limitation to the operating level and production rate of the plant, is rejected into the river as low grade heat by raising the temperature of a large flow of water by twenty-odd degrees and is entirely useless for commercial power. General use of industrial power from atomic energy appears remote in the light of present knowledge. To the technological difficulties of attaining satisfactory thermodynamic efficiency must be added other limitations. In the first place the present basic source of this energy is U235, the fissile isotopic of uranium which occurs in natural uranium at the concentration of only one part in 140. The quantities of this material in the known ore reserves of the world are small indeed and certainly offer no threat as a source of fuel in competition with petroleum and coke. The necessity for protection against radiation by huge barriers will limit its economical application to large installations and exclude its use from small vehicles, ships or aircraft. It can only be said at present that industrial possibilities of atomic energy are entirely dependent on future discoveries that may reward research in the field of nuclear physics.

Greatest Possibilities Lie in Field of Medicine

More immediate application of uranium fission is seen in the production of large quantities of radio-active material. These emit radiation like radium and can be used to replace that expensive element in medicine and in industry. Canadian scientists, and doubtless those of other nations, hope through this means to put radiological treatment of cancer within the reach of the patients of small incomes and permit its wider use. Biochemists and biophysicists foresee application of radio-active material prepared at the Petawawa plant in research of far reaching importance in medicine and pharmacology. The use of radium for industrial radiography has been a rapid development during the war but its use again has been limited by the cost of the element. A more extensive application of this and other industrial uses of radioactive substances can be expected. The costliness of radio-active materials has not encouraged efforts in the past to find wide application for them. Now that similar substances can be produced in large quantities there can be no doubt but new uses will be found.

The achievement of the release of atomic energy has been compared to the development of Watt's first steam engine, Faraday's discovery of the principle of electromagnetism, and to the development of electronic devices which have so revolutionized electrical communication. Indeed we may be at the beginінg of a new era in scientific discovery and invention that will go beyond the farthest vision of our imagination.

Can We Maintain Our Lead?

For the present, Canada is especially favoured by the possession of its natural resources of uranium, and by the lead, of perhaps a year or two, which it shares with the United States and the United Kingdom in the knowledge of the processes and experience of its scientists. This, however, is a position difficult to hold by a nation that loses so many of its scientists by emigration abroad, which is so lacking in the equipment and facilities for atomic and other research, whose universities can so little afford the development of large graduate schools for the training of research workers. These are handicaps which affect every aspect of our industries and national development. The circumstances of war have thrust upon Canada economic and industrial importance and a position in the post war world that will require our most strenuous effort to maintain.

ENGINEERING INVESTIGATION OF THE WATER RESOURCES OF THE COLUMBIA RIVER BASIN

(*Continued from page 585*)

servation of fish and wildlife, and (H) other beneficial public purposes.

3. In the event that the Commission should find that further works or projects would be feasible and desirable for one or more of the purposes indicated above, it should indicate how the interests on either side of the boundary would be benefited or adversely affected thereby, and should estimate the costs of such works or projects, including indemnification for damage to public and private property and the costs of any remedial works that may be found to be necessary, and should indicate how the costs of any projects and the amounts of any resulting damage be apportioned between the two Governments.

4. The Commission should also investigate and report on existing dams, hydro-electric plants, navigation works, and other works or projects located within the Columbia River system in so far as such investigation and report may be germane to the subject under consideration.

5. In the conduct of its investigation and otherwise in the performance of its duties under this reference, the Commission may utilize the services of engineers and other specially qualified personnel of the technical agencies of Canada and the United States and will so far as possible make use of information and technical data heretofore acquired by such technical agencies or which may become available during the course of the investigation, thus avoiding duplication of effort and unnecessary expense."

In order to expedite the engineering investigation the Commission appointed the following four-man board known as "The International Columbia River Engineering Board":

- Major-General T. M. Robins, Deputy Chief of Engineers, United States War Department, Washington, D.C., Chairman of the United States section.
- Mr. Glenn L. Parker, Chief Hydraulic Engineer, United States Geological Survey, Department of the Interior, Washington, D.C.
- Mr. Victor Meek, M.E.I.C., Controller, Dominion Water and Power Bureau, Department of Mines and Resources, Ottawa, Ont., Chairman of the Canadian section.
- Mr. F. G. Goodspeed, M.E.I.C., Superintending Engineer, Department of Public Works, Ottawa, Ont.

The members of the Engineering Board designated representatives from associated offices on the West Coast to take charge of field operations and assist the board in its studies. From these representatives the four-man "International Columbia River Engineering Committee" was formed with the following members:

- Colonel C. P. Hardy, District Engineer, United States War Department, Seattle, Wash.
- Dr. F. A. Banks, Director of Region No. 1, United States Bureau of Reclamation, Department of the Interior, Grand Coulee, Wash.
- Mr. C. E. Webb, M.E.I.C., District Chief Engineer, Dominion Water and Power Bureau, Department of Mines and Resources, Vancouver, B.C.
- Mr. K. W. Morton, M.E.I.C., District Engineer, Dominion Department of Public Works, New Westminster, B.C.

In Canada, inauguration of the various phases of field investigations involved in the overall study had to be completely organized but considerable progress has been achieved already and is being forwarded in such fields as aerial photography, reconnaissance surveying, stream gauging, precise levelling, triangulation surveying, topographic mapping, and ground water studies. Much of this preliminary work has been initiated in the tributary Kootenay River basin where urgency of consideration of storage, flood control, water power and reclamation problems dictated a priority of treatment.

In the United States, the investigations in most instances represented a continuation and co-ordination of field surveys already well under way and progress is farther advanced and covers a wider field of studies.

The Board expects to make a preliminary report to the Commission in October outlining the requirements of future field investigations.

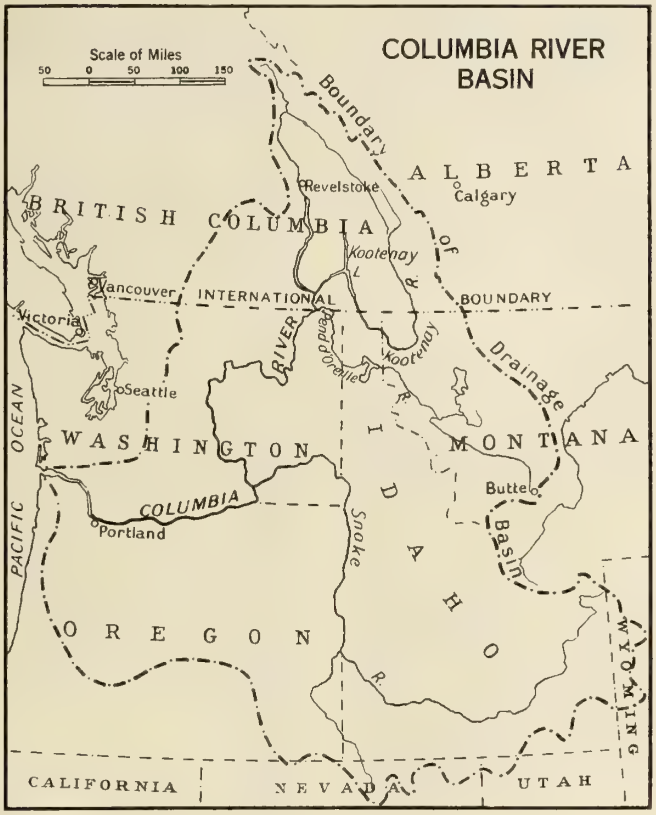
ENGINEERING INVESTIGATION OF THE WATER RESOURCES OF THE COLUMBIA RIVER BASIN

VICTOR MEEK

Controller, Surveys and Engineering Branch, Department of Mines and Resources, Ottawa, Ont.

Public attention has been focussed recently on the basin of the Columbia river in western Canada and the United States where large scale engineering investigations, looking to the future economic development of the water resources of the area, have been undertaken or are planned on behalf of the governments of the two countries.

The Columbia river basin comprises some 259,000 square miles of the Cordillera on the Pacific slope of the North American continent. It includes some 39,700 square miles of southeastern British Columbia, almost all of Idaho, the greater part of Oregon and Washington, western Montana, and relatively small areas of Wyoming, Utah and Nevada. The Columbia river and its tributaries provide drainage for the run-off from this vast area. The main river rises in Columbia lake in British Columbia. In Canada it descends 1,360 feet in 465 miles while, in the United States, it drops another 1,290 feet in the 750 miles from the international boundary to the Pacific ocean. In its overall length of 1,215 miles, it is joined by numerous tributaries of which the Flathead, Kootenay, Pend d'Oreille, Kettle, Okanagan, Similkameen, and other smaller ones cross the international boundary once or more, and emphasize the international character of the river system.



In geographical size the river basin is somewhat smaller than that of the Great Lakes and St. Lawrence river at Prescott, but the average flow at the mouth (230,000 cu. ft. per sec.) is 25,000 cu. ft. per sec. greater than that of the St. Lawrence at Prescott. About one-third of this flow comes from sources in Canada. The large available flow and the steep descents on the main river and its tributaries provide many water power possibilities, some of which are developed. The United States portion of the basin contains more than one-third of the potential commercially useful water power of that country. The Canadian portion of the basin contains many valuable power sites also, concerning which the present investigation will provide necessary data.

Limited piecemeal development of the resources of the basin in the past has led to conflict between interests in both the national and international fields. In the latter category the International Joint Commission has been called upon on several occasions to prevent hardship or damage resulting to the nationals of one country as a result of the action of nationals of the other country. That commission had been set up under the terms of the Treaty of 1909 between Great Britain, on behalf of Canada, and the United States to deal with such boundary water problems.

It was evident that these disputes would increase in number as the resources of the basin were developed and that the most gainful use of the water resources of the area would be lost unless development was carried out under planned co-operation between the two countries and the political divisions thereof. Accordingly, early in 1944, representatives of the state departments and the engineering services of the two countries conferred on the possibility of an overall investigation of the water resources of the basin.

Under date of March 9, 1944, the governments of the Dominion of Canada and the United States of America, in accordance with the procedure provided in Article 9 of the Treaty of 1909, united in the following reference to the International Joint Commission:

"In order to determine whether a greater use than is now being made of the waters of the Columbia river system would be feasible and advantageous, the Governments of the United States and Canada have agreed to refer the matter to the International Joint Commission for investigation and report pursuant to Article IX of the Convention concerning Boundary waters between the United States and Canada, signed January 11th, 1909.

2. It is desired that the Commission shall determine whether in its judgment further development of the water resources of the river basin would be practicable and in the public interest from the points of view of the two Governments, having in mind (A) domestic water supply and sanitation, (B) navigation, (C) efficient development of water power, (D) the control of floods, (E) the needs of irrigation, (F) reclamation of wet lands, (G) con-

(Continued on page 584, to the left)

From Month to Month

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

ENGINEERING FOR VETERANS

One doesn't need to have second sight to see that the engineering faculties of Canadian universities are facing a Herculean task this fall. For a long time they have been making preparations for the impact of the returned man who wants to follow engineering, but there have been many difficulties in the way of completing satisfactory plans. A recent inquiry from the Institute to all deans of engineering has revealed an excellent state of readiness for the opening of the academic year.

Among the difficulties that have been overcome are the uncertainty as to the number who would apply, the provision of additional lecture room space, laboratory space and equipment, teaching staff and finances. All of these have been settled largely, although some part of each problem still remains for further attention.

Most deans report that, by sectioning classes into morning and afternoon groups for lectures and practical work, greatly increased numbers can be handled with existing facilities. In many instances, temporary buildings of the armed forces are to be used or are available if required. In at least two cases, Toronto and McGill, freshmen will be accommodated outside of the city in temporary colleges. The shortage of laboratory equipment threatens to be one of the most serious problems, and it appears possible in at least three universities that night classes may be necessary to overcome it. No university appears to think night work will be necessary, except for labs and draughting.

Finances

Beyond a doubt the greatest problem is finances. The Government is reimbursing the universities, but the allowance seems to include nothing for additional laboratory equipment or buildings. Regular fees never meet the cost of an education, but through private contributions and provincial government grants the deficit is met. With thousands of returning men going to university, these usual methods of financing will never meet the situation.

Not long ago the Government, through the Department of Veterans Affairs, agreed to make, in addition to meeting the regular fees, a supplementary grant of $150.00 per person for the programme of an academic year, providing the total supplied by the Government did not exceed $500. Fees vary between universities, but at Toronto, McGill and Queen's they run about $250, so that, even with the supplementary allowance, the total reimbursement is well under the $500 maximum.

Some universities have reported the relationship between their normal income from fees and their normal total yearly expenditures, as follows: British Columbia, Queen's and New Brunswick, 40%; Saskatchewan, 25%; Toronto and McGill, 33-1/3%; Laval, 20%. The Federal Bureau of Statistics reports that the average figure for all Canadian universities is 33%. Thus it is evident that, when the Government pays the fee plus the supplementary allowance, it is still a long way from paying the actual cost. Veterans should realize that, under this present arrangement, their education is being paid only partially by the federal government, and that somebody else is also aiding substantially. If the finances are a serious problem to the universities now, what will they be next year when the full load of discharged active service personnel is upon them?

The Survey

The Institute's survey was made before registration had really begun, and therefore the figures obtained are approximate only but they are informative, as the following tabulation shows. In the maritime provinces there are five colleges that give instruction for the first two years only of an engineering course. Unfortunately their figures for registration of veterans are not included in this table; but will be secured later. It should be noted that these estimates are for fall registration only. Early next year additional groups will be taken in at most universities. Toronto estimates its registration in this latter group at from 1,000 to 1,500.

University	1st yr. 1941 *	1st yr. Veterans 1945	1st yr. Civilians 1945	2nd yr.	3rd yr.	4th yr.
British Columbia..	190	200	200	150	100	100
Alberta.....	107	135	50	105	75	85
Saskatchewan	166	200	200	...	...	...
Manitoba....	80	150	100	85	60	75
Toronto.....	470	500	300	...	...	...
Queen's.....	200	200	150	200	150	150
McGill......	112	275	125	200	185	...
New Brunswick......	50	70	45	64	50	38
N.S. Tech. Coll.......	...	...	...	...	57	38
Ecole Polytech...	122	133		83	62	64†

*Note—1941 figures given for purpose of comparison.
†Five-year course: 47 students in 5th year.

Engineering is Popular

The task of educating the veteran is going to fall principally upon the engineering faculties. Statistics of the services indicate that the majority of those who contemplate going to university have named engineering as their selection. The University of Toronto, through its interviewing officers, has discovered that about 50 per cent of all service men are primarily interested in engineering and a further 10 per cent in engineering or pure science. Toronto estimates that it will have to accommodate, throughout the demobilization period, about 4,000 freshmen in engineering.

These figures make new records. They speak volumes for the courage and organizing ability of our education administrators. Truly these men with their staffs are greeting the returning heroes with a genuine "welcome home".

R.C.E.M.E. OFFICERS — ENGINEERS OR TRADESMEN?

In these columns there has been a lot of criticism of the treatment of engineers in the Ordnance Corps and later in the Royal Canadian Electrical and Mechanical Engineers Corps. Eventually, on paper at least, the situation looked to be improved, although there were but few manifestations that the policy towards engineers had been changed. Non-technical appointments continued to be made to what look like technical positions and previously made appointments of the same kind seemed to remain unchanged, although it is admitted there is no scarcity of technical and professional applicants for commissions. The letters from officers at Petawawa published in this issue under the heading "Idle Engineers" would seem to prove that.

At one stage in the Institute's earlier negotiations with the Department of National Defence, the Master-General of the Ordnance stated that no more non-professional people would be given engineer appointments in the Corps as long as engineers were available. This was what the Institute had been asking for, and so a certain amount of satisfaction was enjoyed for a few fleeting weeks. This "fool's paradise' blew up suddenly when Canadian Army Routine Order No. 5612 appeared last spring.

The order was headed "Royal Canadian Electrical and Mechanical Engineer Classifications and Qualifications." It stated what an Electrical and Mechanical Engineer (E.M.E.) must be, which was not too bad, i.e.:

(a) a graduate in Electrical or Mechanical Engineering from a recognized Canadian University or College or from an institution legally recognized as having equivalent standing. (A science graduate in Physics may be considered as equivalent for Telecommunications.)

—or—

(b) an engineer with extensive experience in Electrical or Mechanical Engineering who is recognized under Dominion or Provincial law as qualified to perform such work.

The order goes on to describe an Electrical and Mechanical Assistant Engineer (E.M.A.E.) who "will be appointed from the ranks of qualified warrant officers" etc. and a Mechanical Officer (Mech. Offr.) who "will be a tradesman appointed from the ranks" etc. or "a person from civilian life" etc. An Executive Officer (E.O.) will be "a tradesman appointed from the rank" etc. or "a person from civilian life" etc.

Then in the last paragraph the order says "notwithstanding the above noted classifications, Electrical and Mechanical Assistant Engineers, Mechanical Officers and Executive Officers may be posted to any Electrical and Mechanical Engineer vacancy in authorized War Establishments". In other words, "a tradesman appointed from the ranks" or "a person from civilian life" could become an Electrical and Mechanical Engineer!

The Institute wrote the O.C. of the Corps on June 7th to ask if the order meant what it seemed to say. After pointing out the possible implications of this, the letter concluded with this paragraph, "If this is what is meant, I think it is a very serious development. Before bringing it to the attention of the Institute's Committee on the Engineer in the Active Services, I would like to have some official word from you as to whether or not I am right in my interpretation."

There was no reply to this enquiry and, on August 7th, the general secretary telegraphed a further inquiry. The next day a telegram was received saying that the letter of June 7th had been "considered as personal" and recommending that an official presentation of the case should be made to the Department. This was done on August 9th.

At the present date, September 8th, there is still no reply and no acknowledgment.

. . . . LATER . . . .

Since the above was written a letter has been received at Headquarters from the office of the Minister of National Defence. The significant portion of this letter is found in a statement that C.R.O. 5612 has now been amended "in view of possible misinterpretation". The *Journal* is pleased to present to its readers the complete letter so that the intention of the Department may be clarified.

Department of National Defence
Office of the Minister
Ottawa

September 11, 1945

L. Austin Wright, Esq.,
General Secretary,
The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal, Que.

Dear Mr. Wright:

As promised in our telephone conversation yesterday afternoon, I am sending you extracts from the report submitted on the status of non-professional officers in the Corps of Royal Canadian Electrical and Mechanical Engineers. These extracts follow:—

The Corps of Royal Canadian Electrical and Mechanical Engineers is organized as a separate Corps made up of independent units. Each unit has its own laid down scale of personnel, weapons and equipment, or what, in other words, is officially referred to as an Establishment. Establishments provide a scale of ranks in addition to the numbers of personnel. Such scales of rank bear no relation to the appointment such as Electrical and Mechanical Engineers, Electrical and Mechanical Assistant Engineer, Mechanical Officer or Engineering Officer. The appointment made to cover any such rank depends on specific requirements, technical or otherwise, and the availability of officers.

As a Corps this organization must, of necessity, provide for the advancement of personnel from the ranks to commissioned status. Provision must also be made for the employment of personnel with the required specialized knowledge when the exigencies of the Service demand. The first case pertains to Armament Artificers who become Electrical and Mechanical Assistant Engineers, Artisans become Mechanical Officers and Clerks (also Storemen) become Executive Officers. The second case pertains to civilians possessing specialized technical knowledge or skill required for the efficient operation of the Corps.

In view of the possible misinterpretation of intentions, Routine Order 5612 has been amended by Routine Order 5831, which cancelled para. 3 and substituted—

"Officers of the above classifications will be posted in accordance with establishment requirements."

the intention being that the classification of the officer posted will depend on the functional demand of the establishment. It is an accepted principle of the Corps, however, that officers classified as Electrical Mechanical Engineers can fill any and all appointments of the Corps.

I think it would be advisable also to record the analogy between the status of these officers and non-medical officers in the R.C.A.M.C. who hold administrative appointments. I might add that your interest in the Corps is appreciated by the Officers at Headquarters here and particularly the care that you have taken to ensure that hasty action was not taken until this particular matter was clarified.

Yours sincerely,

(Signed) H. L. Cameron, Colonel,
Military Secretary.

IDLE ENGINEERS

Herewith are two letters that touch on an important topic—the demobilization of engineers. Similar letters from other officers at Petawawa have been received at Headquarters to the number of sixty. Upon their receipt the Institute's Committee on Rehabilitation immediately considered the matter and discussed it by telephone with the proper officials at Ottawa. The Committee made two suggestions, which it was promised would be given every consideration. The suggestions were—

a) That the engineers at Petawawa be sent overseas to replace engineers with long service now on duty there, who desired to return to peacetime occupation here.

b) Failing the above, give the Petawawa engineers leave-of-absence to find civilian employment, after which they would be given discharge.

Both of these suggestions were based on the fact that there is a serious shortage of engineer-manpower in the civilian field, and that usually the employment of engineers develops work opportunities for many others. The employment of these young men would appear to be in the interest of the whole rehabilitation programme, regardless of whether or not they have the necessary number of "points" to be entitled to a quick discharge. At the moment all they are doing is "eating their heads off".

In response to the committee's proposal, the following information and advice has been supplied from Ottawa under date of August 31st. It is quoted from a letter sent personally to the chairman of the committee, Major-General Kennedy, and therefore the *Journal* is not free to publish it in its entirety or to disclose its authority.

"Before this letter from A-5 C.E.T.C. was written, plans had been well prepared to take care of the personnel in training at this Training Centre. The C.A.P.F. and C.A.O.F. would have absorbed many and in addition a number were required for service with E.W. & W. Coys. throughout Canada to relieve older officers eligible on the point system for retirement and others who will be returned to industry as a result of the operation of the Industrial Selection and Release Committees.

"Plans, of course, will have to undergo revision in the light of the end of the war with Japan and it is probable that those earmarked for the Pacific will not now be required for that purpose, at least not in the numbers formerly anticipated. The same situation is true in respect to officers of all Arms and Services and these R.C.E. officers, who are impatient at their present role, are in no worse position than those of other Arms.

"It should be mentioned in passing that of the 92 trained R.C.E. Reinforcement Officers in Canada, including those at A-5, only three have been qualified for more than two years. All these officers were employed as opportunity offered in C.E.T.C.'s., O.T.C., E.S. & W. Coys., and other Establishments and Schools as well as at Formation Headquarters. Every attempt has also been made to increase their knowledge and make their service more attractive by means of various courses.

"As you well know, should the services of any one of these officers be urgently required for industry, they can be obtained through the operation of the Industrial Selection and Release Committees.

"Until the changes in policy and plans necessitated by reason of developments have been fully promulgated, I cannot state how these young officers will be dealt with individually. You may be sure, however, that as the problem is a general one pertaining to all Reinforcement Officers and not alone to R.C.E. Officers, it will have a considerable measure of review and consideration. In due time, when all the multiple factors have been properly assessed, it is hoped that the situation may be resolved, if not to the satisfaction, at least to the understanding of all concerned."

In all fairness one must acknowledge the rights of others to be demobilized, and the department official states their cases very clearly, but the reference to the possibility of these engineering officers getting discharges should their services "be urgently required for industry" may carry more weight than it should. How are these young men—some of them never employed before—going to find out if their services could be used to the general advantage, if they are not given the opportunity to look around? The record shows that it is not too easy to obtain discharge through the Industrial Selection and Release Committees.

The problem is not simple. Let us hope that when "the policy and plans have been fully promulgated" they will be generally acceptable to all concerned.

(A-5) C.E.T.C.,
Petawawa Military Camp,
Petawawa, Ontario,
4th August, 1945.

L. Austin Wright, M.E.I.C.,
Secretary, The Engineering Institute of Canada.

Dear Sir:

For up to two years now, a large number of fully trained RCE Reinforcement Officers who are engineer graduates from various Canadian universities have been held in (A-5) Cdn Engr Trg Centre, patiently yet unsuccessfully, waiting to be despatched to an active theatre of operations.

After VE Day, a large number of these officers, strongly desiring to see front line service, and feeling obligated, volunteered for service with the CAPF. Towards the end of June, a high ranking officer from RCE HQ addressed the officers at Petawawa and stated that there was practically no chance of their seeing action with the CAPF, because of the more than ample supply of volunteers from overseas. He also stated that there was no possibility of being released to civilian status because of the priority discharge system.

Since that time, application has been made requesting that excess RCE Reinforcement Officers be loaned to the American Army Engineers where it has been learned a shortage exists. No results have been forthcoming.

It is felt that the present priority system of releasing service men from the Army should not apply to professional engineers as there is an over all shortage of such personnel in Canada. It is also felt that the present system is unjust in that engineers now graduating are not liable for military service, and are now filling positions which would be more capably held by more experienced engineers. Moreover, many graduates of the past few years who did not volunteer for service in the forces are now strongly consolidating their positions in industry at our expense.

After due consideration of the matter and after some consultation with prominent civilians and Army officials, it is requested that immediate action be taken to clarify government policy with respect to professional engineering. As can be realized, a great deal of professional engineer ability has been and will be lying stagnant in this Training Centre under the present conditions. Not only are these Engineers being of no benefit whatsoever to either their country or themselves, but they are actually an excess and unnecessary expense and burden to the taxpayer. Engineering is the backbone of industry and if the trained engineer ability now being wasted in this Training Centre was released to civilian use, a great many additional jobs of all kinds would be created for the layman.

It is respectfully suggested that to expedite this matter, the problem be handled by the most competent body—The Engineering Institute of Canada. It is requested that immediate action please be taken to either

(a) get some specific assurance that the professional engineers who are now RCE Reinforcement Officers in this Training Centre will be used constructively as Reinforcement Officers in the Pacific Theatre of Operations, or

(b) obtain release to civilian status, subject to recall, for the large excess of graduate engineers in this Training Centre, so that many of the now existing shortages in the engineering industry in Canada may be filled.

Any action which is taken to alleviate the above condition will be greatly appreciated. The strong desire of engineering graduates in this Training Centre is to "*get into action*" either in the Army or in civilian engineering projects—in short, to stop wasting ability, money and time. Too much has been wasted already.

You can be assured of the whole-hearted support of all Engineer officers stationed at Petawawa who are looking to The Engineering Institute of Canada for leadership at this time.

Respectfully,

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No. 8 Can. Fld. Sqd.,
R.C.E., C.F.N.
August 8th, 1945.

Major D. C. MacCallum,
Rehabilitation Officer,
The Engineering Institute of Canada,
Montreal, Que.

Dear Sir:

The Employment page for June has finally reached me after a very circuitous route.

The positions offered seem to picture quite a cheery present day scene, nevertheless the problem that many of us are confronted with, is not today, but tomorrow.

It is, I believe, quite apparent that employers will naturally take those men who are readily available. It is also quite as apparent that as the present Eastern conflict progresses, further redundances in industry will occur, releasing other engineers for such positions as are available.

There are numbers of us over here, whose prospects of return to Canada are very shadowy indeed. In fact so very shadowy, we cannot hazard a guess as to when the day may be. Contacting such firms from this distance under such uncertain conditions seems rather dubious to say the least.

We hear tales of the great demand for technical personnel and I've read that a large public works project in my home province of Alberta is held up because of the lack of the necessary engineers. Still we pass the days, doing nothing but wondering on what short-sighted policy the present reconversion is taking place.

It becomes increasingly obvious that the engineering personnel in the Army, particularly overseas, will find themselves in a severe position in regards to employment and that such service as one might have had in the armed forces still leaves the service personnel at a disadvantage with respect to those who have continued in their profession.

In that statement I do not mean to condemn those who have continued their civilian employment, on the contrary I believe they have contributed more to the war effort than I personally have, and I believe that the engineering profession made a big mistake in allowing so many of its members to leave their positions, for the very limited employment the Army has to offer.

Yes, I am still not satisfied with the manner in which the engineering members of Canada are being treated under the present conditions.

Yours very truly,

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MULBERRY IS HERE

The Canadian tour of the War Office model of the world famous pre-fabricated harbour that was towed to Normandy, opened at the Chateau Laurier, Ottawa, on September 4th. His Excellency the Governor-General performed the ceremony after being presented by Sir Patrick Ashley-Cooper, Governor of the Hudson's Bay Company.

Sir Patrick Ashley-Cooper, Governor of the Hudson's Bay Company, shows the working model of the spud pontoon pierhead to His Excellency the Governor-General at the opening of the Mulberry Exhibition in Ottawa.

The model measures up to its advance notices. Not only does it amply illustrate the great project of Mulberry but shows the art of model building at its best. It brings great credit to British engineers and craftsmen. Every Canadian should see it. Engineers should be warned that this exhibition is not something to be seen casually or hastily. It represents one of the greatest accomplishments of the engineering profession, which cannot be comprehended or appreciated in a few minutes. To examine every section of the model and the photographs in detail is to see the whole exciting story unfold before you—the trials and disappointments, the changes in plans, the vicissitudes of labour supply, the vagaries of weather and the ultimate triumph. Plan to give it all the time it deserves—you will be amply rewarded.

The exhibition opens in Montreal at the store of Henry Morgan & Co., Limited, on October 3rd, and remains open until October 20th. From there it goes to Toronto. The itinerary with all the details so far determined is:

Toronto —The Robt. Simpson Co.,
—Nov. 5th to Nov. 24th, 1945
Windsor —The Armouries
—Dec. 12th to Dec. 18th, 1945
Hamilton —The Armouries
—Jan. 7th to Jan. 12th, 1946
Winnipeg —The Hudson's Bay Co.,
—followed by Regina, Calgary, Edmonton, Vancouver, Victoria, Quebec, Saint John, and finishing up about June, 1946, in Halifax.

As announced previously the model has been loaned by the War Office, and is touring Canada under the sponsorship of the Hudson's Bay Company in collaboration with The Engineering Institute of Canada. The Institute committee is made up of C. E. Sisson and M. J. McHenry, both of Toronto.

INTERNATIONAL MEETING—INAUGURAL MEETING AND COUNCIL MEETING

The week end of October 5th promises to be a memorable one in the history of the profession. On the Friday and Saturday three important events are scheduled to bring American and Canadian engineers together, to bring members of the Institute from many parts of Canada to join with others in the Detroit-Border Cities areas in a series of noteworthy occasions.

International Meeting

In response to an invitation of the Detroit Section of The American Society of Mechanical Engineers, the Border Cities members of the Institute are joining in an international meeting which is being held in Detroit on Friday, October 5th. This marks the return to the pleasant custom of joint international meetings which was so much enjoyed before the outbreak of war, by the cities on both sides of the border.

In the afternoon, there will be a visit to the plant of the American Blower Company. Instead of the usual plant inspection, the party will be taken to the research and development laboratory, where there are many new and interesting projects under way. Such a visit will afford many engineers their best opportunity to see something of what is ahead for postwar industry and engineering.

In the evening, dinner will be served in the Rackham Memorial Building, after which General A. G. L. McNaughton, M.E.I.C., will speak in the large auditorium to an audience which will include members of all engineering societies in Detroit. His subject is "Canadian Engineering in the War.—A Tribute to the Part Played by Canadian Engineers". General McNaughton is an Honorary Member of The American Society of Mechanical Engineers.

The Border Cities Branch desires to have a large turnout of members from other parts of the province and from other provinces. The return to the exchange of peacetime ideas and courtesies across the border well merits the attendance of large numbers. For a complete programme and later details, communicate with your branch secretary who will be kept informed by the Border Cities officers.

Inauguration of Sarnia Branch

As announced previously, a new branch is to be opened in Sarnia. The afternoon and evening of Saturday, October 6th, is being devoted to this ceremony. In the afternoon there will be plant visits and golf, and at the evening dinner the presentation of the charter. A certain amount of speech-making is inevitable, but the main purpose is to give the newest member of the Institute family an enthusiastic welcome, and an assurance of support and co-operation from all branches. To do this properly will require the attendance of a substantial representation from other branches.

New branches are of great importance and of sufficiently rare occurrence that all members of the Institute should give their support to this first meeting of the Sarnia Branch. For further details, consult your branch secretary.

Council Meeting

To round out the weekend and to take advantage of the many officers, past and present, who will be at

INTERNATIONAL MEETING AT DETROIT

October 5th

Joint Meeting of the Detroit Section of The American Society of Mechanical Engineers and the Border Cities Branch of the Institute

2.45 p.m. Plant visit: American Blower Corporation, 8111 Tireman, Dearborn, Michigan.
Heavy manufacturing of fans, fluid drives, dust collectors, air washers. Visit of Research Laboratories for dust analysis, sound testing, and fluid air development, where actual experiments will be conducted.
A modern office air conditioning system will be available for study.

6.30 p.m. Dinner. (Dress informal.)
Horace H. Rackham Memorial Building (Banquet Hall), 100 Farnsworth Street, Detroit.
(Ladies and Guests invited).

8.00 p.m. Meeting.
Horace H. Rackham Memorial Building (Large Auditorium).
Speaker: General A. G. L. McNaughton, M.E.I.C.
Subject: **"Canadian Engineering in the War — A Tribute to the Part Played by Canadian Engineers."**

Ladies are invited to attend the dinner and the evening meeting. In the afternoon there will be in attendance at the Horace H. Rackham Memorial Building a ladies committee which will arrange for the use of the game facilities such as cards, bowling, ping pong, billiards or trips through the Detroit Art Museum or Library which are adjacent to the Rackham Building. The committee will also assist in directing visiting ladies to the shopping centres or any other points of interest in which they may be interested.

COUNCIL MEETING AT WINDSOR

October 6th

A Regional Meeting of Council of the Institute will be held at the Prince Edward Hotel in Windsor, at 9.00 a.m., on Saturday, October 6th

All past officers of the Institute in the province of Ontario are invited, as well as chairmen of Institute committees and of branches.

INAUGURATION OF SARNIA BRANCH

October 6th

3.30 p.m. Golf tournament at Sarnia Golf Club.
or
Inspection trips to Polymer Corporation, Imperial Oil Company or other plants.

7.00 p.m. Dinner at Sarnia Golf Club. (Dress informal.)
Presentation of Charter to the Sarnia Branch.
Addresses by officers of the Institute.

See your Branch Secretary for further details

the International Meeting and the Inaugural Meeting, Council will hold a regional meeting at the Prince Edward Hotel in Windsor at 9.00 a.m. on the morning of Saturday, October 6th. As is customary for such meetings, all past-councillors of the branch will be invited, also all past-presidents and past vice-presidents of the province and the executive of the branch, as well as chairmen of Institute committees, and certain other guests.

These three events constitute an attractive programme. It is to be hoped that its pleasures will be shared by a large and representative group. The engineers who are hosts on these occasions invite all members, and urge that nothing be allowed to keep them away.

The meeting in Detroit is for ladies as well. In the afternoon during the plant visit, special facilities will be made available by the Detroit wives. The week-end has been chosen specially to permit Canadians to have adequate time to enjoy their inauguration of the return of normal times as far as " across the line " visits are concerned.

WHAT NEXT IN COLLECTIVE BARGAINING?

The cessation of war will mean the cessation of war legislation, which for the purposes of this article is Order-in-Council No. 1003. Through this order and the ruling of the Minister of Labour, professional workers have secured the right to bargain for themselves, by an agency of their own selection or creation. The *Journal* has been informed by one of the persons who knows, that in a matter of a few weeks, the order will go " out the window ".

When the order goes what happens to the ground gained so painstakingly over the last eighteen months ? Of course, the authority to legislate and govern will go back to the provinces, and at the moment there is no provincial legislation that provides the same privilege. As a matter of fact the legislation, in both Ontario and Quebec at least, implies that professional people are excluded from collective bargaining. Professional employees through their various societies last year recorded with emphasis that they wanted collective bargaining for themselves within their own control. Will they be allowed to have it under provincial legislation? It looks as though the whole struggle would have to be restaged in the provincial arena.

The Institute's Committee on Employment Conditions reported at length to the September meeting of Council. This report summarizes the story of all happenings up to September 7th. It describes the Institute's interest in securing for its members, in combination with other societies, the right to bargain collectively under favourable conditions. It points out that the right has been established legally and that engineers now have the privilege which they were seeking. It remains for them to use the legislation to their own best advantage.

False Rumours

In some quarters there has developed the impression that the Institute is not favourable to collective bargaining for engineers. Just how this could have happened is difficult to understand. The record is there for anyone to read, and it indicates clearly that the Institute has taken a leading part in studying the situation, in gathering the opinion of its members, and in securing for them the benefits which they so clearly indicated they desired.

Throughout all the deliberations of the Committee of Fourteen, the Institute has held consistently that collective bargaining should be available to all those who wanted it and who were eligible to use it. It bore the lion's share of the cost both in time and money for the joint study of the problem and the appeals to the Minister and the Board on behalf of the employee-engineer. It still adheres to its policy. It regrets that anyone—member or otherwise—should now gain a false impression of where the Institute stands.

From the beginning, in spite of several requests from member and branches, the Institute committee and the Council have been firm in the opinion that the Institute should not by itself, set up a bargaining agency. The Committee of Fourteen agreed unanimously that an endeavour should be made to have only one bargaining agency for professional workers in each province, and that it should be a cooperative organization, so that all workers and groups could use it, without restriction. The Institute committed itself to full co-operation on this basis.

In Ontario and in Quebec there has been established a collective bargaining agency described as a "federation ". Each federation was set up solely by the provincial registration body, and membership in it—as far as engineers are concerned—is limited to members of the provincial registration body. Therefore it is not the open co-operative organization agreed upon by the Committee of Fourteen. The Institute does not quarrel with this development. If this is what the engineers want and it is acceptable to the War Labour Boards, the Institute is satisfied, but it is a different setup from that to which the Institute committed itself along with the other societies that made up the Committee of Fourteen.

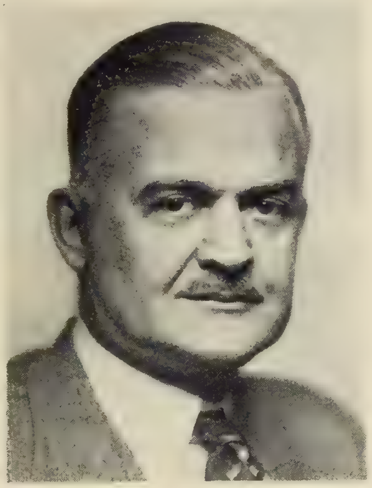
The Institute wishes the federations, wherever they may be formed, the utmost of success. If through them every engineer can satisfy his collective bargaining needs, then the objectives of the Institute in such matters have been realized.

At the same time it should be kept in mind that the Institute is continuing its interest in the economic welfare of the profession. It is still available for the use of members in all such matters. The intensive study given to the subject by the Committee on Employment Conditions places it in a position to give expert information and advice wherever and whenever it may be required. At all times will it welcome inquiries. At any time it feels there is something more which the Institute should do in this field, it will undertake the task without hesitation.

WARTIME BUREAU OF TECHNICAL PERSONNEL

New Director

Mr. H. W. Lea, at the request of the Minister of Reconstruction, has transferred to the Reconstruction Department to take over important duties in connection, with post-war construction programmes. Since April, 1942, when Mr. Lea became Director and previously as Chief Executive Officer, he has devoted his efforts to the effective utilization of technical and scientific talent in Canada, and consequently his loss will be keenly felt. However, the Department of Labour and the Bureau's Advisory Board fully realized that Mr. Lea's abilities were urgently needed in the Department of Reconstruction, and the transfer was approved. The very best wishes of the Bureau staff accompany him into his new duties.



J. M.Dymond

Mr. J. M. Dymond, Chief Executive Officer of the Bureau, has been appointed to succeed Mr. Lea as Director.

Supply and Demand

While it is generally assumed that the peak of the country's war effort occurred in August, 1943, the rate at which technical persons have been absorbed into new civilian employment has shown no particular variation over the whole of the past three-year period. There is, naturally, some increase in the rate at which permits are issued during the first few months of each fiscal year due to the absorption of new graduating classes, and approximately one-half of the permits issued in any one year are concentrated in the months of April to July, inclusive. The total number issued in each of the three years ending July 31, 1943, 1944, and 1945, amounted to 4,757, 4,777, and 4,867, respectively. This would indicate that any curtailment in the use of technical persons due to reduction in direct war programmes has been offset by expansion in lines which have begun to assume more and more importance. As part of the post-war economy in building up staffs for this latter type of activity, it is natural that requirements for engineers and scientists should be met somewhat ahead of the needs for other types of skill. A great deal of the work which will eventually absorb substantial quantities of skilled and unskilled labour is still in the planning and development stage, which it is largely the function of technical persons to undertake. The one significant difference in the figures covering permits issued over these past three years is that in the latest 12-month period over 500 of the permits covered the engagement of technical persons who had been on active service, whereas in earlier years the number of ex-servicemen was more or less negligible.

Special Survey

During July, one of the main items covered by the survey was a study of the extent to which various employers had been absorbing technical personnel during the years the Bureau has been in operation, as well as a breakdown of the types of training of engineering and science which various employers have required. While this does not, of course, indicate the total number of technical persons normally required by the concerns in question, it is, however, a useful record of those most likely to require staff of this type in the future.

The total number of employers to whom permits have been issued since the Technical Personnel Regulations became effective in March, 1942, is slightly over 2,000. While more than one-half of these employers have required to engage only one or two technical persons, about 100 employers have engaged 20 or more during the period stated. The cooperation of these and larger employers is being enlisted with a view to securing more definite information as to their absorptive capacity in this field of manpower, particularly regarding opportunities which may exist for those who are to be returned to civil life from the armed forces.

NEW YORK LETTER

So much has happened since the final " Washington Letter " was written a month ago, that I cannot resist the temptation of recording some of it in what might, for want of a better title, be called a " New York Letter ". However, the events of the last month have been so universal in their importance and implication that they may be written about with equal appropriateness from Washington, London, Chungking or Timbuctoo. Apart from this, of course, with W.P.B. dropping controls as fast as possible with the termination of Lend Lease, and with every effort being bent to return to normal trade channels and to build up international trade, the star of New York is in the ascendant; and this great metropolis will again assume its place as the commercial capital of the continent. Sitting in the great executive chamber of a famous banking house discussing the import of recent developments and looking out on the historic corner of Wall St. and Broad, I could not help but feel " This is where things are going to happen ".

Only a few short months ago, these letters recorded another " ten days that shook the world "—a ten days which saw the crumbling of the German Empire, the death of two dictators and the end of war in Europe. And now another ten days opened with naval and air assault on the home island of Japan in full blast. Then most dramatically and from a battleship bringing him back from the successful Potsdam Conference, President Truman announced that the first atomic bomb had been dropped on Hiroshima with devastating effect. Next Russia declared war on Japan and started an overland drive so rapid and crushing in its effect as to compare favourably with any of the other great drives in this war. News of this drive was, however, overshadowed by the rapidity with which overall developments took place. A second, more up-to-date atomic bomb—one which rendered the Hiroshima one obsolete—was dropped over Nagasaki. The great news story broke of the two billion dollar project which had produced these bombs; and what for months had been whispered of in Washington's most confidential circles as the "Manhattan Project" was announced to the world. Within days, Japan sued for peace. There followed a most interesting set of exchanges involving a concept and an Emperor. There was the inevitable "false armistice"; I was in Times Squares for this and resolved to stay away from there in future celebrations! Two days later actual cessation of hostilities was officially announced and New York joined the world to outdo itself in celebrations.

During the month, the British election results were announced giving an overwhelming victory to the Labour Party, and administering to Mr. Churchill the first repudiation of a war time government in recent elections in English speaking countries. South Africa, United States, Australia and Canada, in hotly contested elections, all returned the party in power at the time. What appears to this country as a swing to the left and away from free enterprise has been viewed with some alarm. On the other hand, the complete unanimity between Mr. Atlee and Mr. Churchill and between Mr. Bevin and Mr. Eden on foreign policy, particularly in resistance to totalitarian tendencies in Europe, is reassuring. Because of difference in parliamentary systems, it is difficult for this country to assess just what the British election meant. The tendency is to look at it from the point of view of Mr. Churchill's defeat. Leading editorials, particularly in the *New York Times,* were very fair and understanding in their comments. The fact that Mr. Churchill makes no complaint, turns down proferred honours, and, as Leader of the Opposition, is as vocal and as forceful as ever is noted and appreciated. I was reading a book the other day which said that, no matter what the immediate version of the British electorate might be, Mr. Churchill's place in history and in the hearts of his people was assured as he had saved them from disaster and from invasion. The book was published in 1921!

One of the major reasons for the defeat of the old government and the major problem confronting the new is the question of housing. All over the world the housing problem is so acute that at long last some significant advances against prejudice, vested interest and inertia, may be made in the most important art of housing. Certainly a great deal of thought and money and research is being expended on the subject.

The unexpected suddenness of the end of the Japanese war has upset a number of things. It brought the termination of Lend Lease only a month or so after the beginning of another year's plans—all predicated on the continuance of Lend Lease. It caught reconversion plans admittedly in full swing, indulging in a thoroughness which had hastily to give way to make shift. Many industries were caught with their plants down! In a very short time, over a million workers were released because of cut-backs, and war contract cancellations reached six billions. Unemployment as high as six million by early spring is predicted. But this will be only a transition period, we are assured, as vast reconversion plans go slowly into motion. Congress is being called back early to enact appropriate legislation. The "Full Employment Bill" is being widely backed. In endorsing the Bill, Secretary of State Byrnes says that full employment in America will "certainly affect and may even determine the direction of the world's political and economic development". Private industry is being greatly encouraged by the rapid relinquishment of controls and its own plans move forward apace. Great research and experimental centres like those for General Motors or the oil companies are being planned. Between three and four million radios are scheduled before the end of the year and the automobile industry will shortly be in full swing. All construction bans are rapidly being lifted. It is significant that there has been hardly any recent cut-back in the machine tool industry.

New York might be taken as an example. Colourful, efficient, enthusiastic Mayor LaGuardia has announced an "all embracing, all comprehensive" organization to handle the many problems of reconversion. Several billion dollars worth of projects are actually ready to go ahead or are in the advanced planning stages. A number of large housing projects are going forward in addition to a backlog task of about two billion dollars replacing old tenements. Then the Board of Transportation has submitted to the City Planning Commission a billion dollar subway extension programme to extend over six years. There are both dangerous and interesting days ahead. Oh, yes! There is a wonderful new Idlewild Airport being constructed in Queens at a cost of about two hundred millions of which Mayor LaGuardia recently said, "I take this opportunity to announce to the entire world that we have the best damn airport in the whole world!"

As this is written DeGaulle is in Washington. Gen. MacArthur is about to make good his invitation to newsmen when he set foot in Australia from Bataan, "I here now invite you to be with me when I land in Tokyo, for that is where I am going!" Anxious eyes are turned on China, Greece and Bulgaria, and President Truman and his aides have been very outspoken about Argentina and Spain. Australia's Evatt has hard things to say about London. Controversy still rages round the use of the atomic bomb.

These letters have several times mentioned Ben Smith, now British Minister for Supply in Washington. I recently had occasion to write and congratulate him on three counts at once—his receiving a knighthood from the King, his re-election, and his appointment to the Cabinet as Minister of Food.

Reverting for a moment to peace celebrations—the *New Yorker* whimsically observes that the people were so happy they made 5,438 tons of litter—more than double the total for any previous celebration in a city of reputedly heavy paper throwers—1,750 tons were thrown at Lindbergh, 1,800 tons at Howard Hughes and about the same at Corrigan, according to the *New Yorker's* interview with the Sanitation Department. Because of the paper shortage and specific exhortation, New York threw only 77 tons at Eisenhower. The V-J day celebration took seven thousand men, seven hundred and fifty trucks and three days of double shifts to clean up. "Do you suppose . . . . ?" the Walrus said.

E. R. Jacobsen, M.E.I.C.

August 27th, 1945.

4577 Coolbrook Ave.,
Montreal 28, Que.
September 1st, 1945.

Mr. D. C. MacCallum,
Rehabilitation Officer,
The Engineering Institute of Canada,
Montreal, Que.

Dear Mr. MacCallum:

Referring to our recent conversations regarding openings in the sales engineering field, I am pleased to be able to tell you that one of the suggestions you gave me has resulted in the offer of a very satisfactory position which I have accepted.

I should like to take this opportunity to thank the Institute for the active support and encouragement given to the members who are seeking rehabilitation to civilian life. The establishment of this branch of the organization has been of immeasurable help to me in the all-important problem of taking up my profession after service with the Army.

I also wish to express my appreciation to you personally for the very friendly reception accorded me and the sympathetic and practical consideration given to my requirements.

I wish you every success in your efforts to assist other members and if at any time I can be of help please do not hesitate to call on me. If you would care to use this letter for publicity purposes I shall be very glad to have you do so.

Yours very truly,

(Signed) Stewart A. Charters, s.e.i.c.

Barriefield, Ont.,
August 12th, 1945.

Dr. L. Austin Wright,
2050 Mansfield St.,
Montreal, Que.

Dear Sir:

I was pleased to learn that I had received "The Engineering Institute of Canada Prize" at the University of British Columbia for the year 1945, and also to receive your letter of congratulation. Thank you very much. I shall endeavour to be worthy of this honour.

It may interest you to know that out of thirty boys from third year mechanical and electrical engineering in the class of '46 who were chosen from all Canadian universities for the army course in R.C.E.M.E., three were winners of the E.I.C. prize for 1945 (Maxwell of Manitoba, Scharry of Ecole Polytechnique and Scott of British Columbia).

I am looking forward to aligning myself more closely with the different engineering societies, the A.S.M.E. and particularly the E.I.C. upon my return to university in the fall. Thank you again for your interest.

Yours sincerely,

(Signed) Tom F. Scott.

355 King Street West,
Toronto, Ontario.
July 23rd, 1945.

L. Austin Wright, Editor,
The Engineering Journal,
Montreal, Que.

Dear Sir:

There is manifold evidence to confirm that we, as engineers, have long shared and contributed towards a wider horizon of interests than those related only to man's material advancement.

All of us have vivid memories of long evenings around glowing camp fires or smoke-clouded cookhouses or in small country hotel rooms, when several engineers gathered together for a chin-fest and when great tales were told. Tales of trail blazing, of achievements under adversity, of discovery and invention, of humour, of excitement and danger and sometimes incredible tales too were invariably told with a keen knowledge and understanding of human qualities and personalities and of their mental, moral and spiritual implications.

Such tales of engineers and of engineering will always have a stimulating and inspiring influence on the ideals, ambitions and understanding of all engineers, and especially younger engineers and those whose goal lies in the field of engineering. But, except by remote chance, remarkably few of these epic tales have yet been recorded in print and I believe that unless an immediate effort is made, many of the best and most inspiring stories may ultimately be completely forgotten.

Therefore I would like to recommend that consideration be given to introducing a new column in *The Engineering Journal* to be entitled "Engineering Reminiscences", "Pioneering Experiences", "Engineering Horizons" or a similar acceptable title.

I believe that such a column would stimulate a wide interest among engineers and would greatly enhance the pages of the *Journal*. Also it is certain that many of our senior engineers could and would be willing to contribute challenging and stimulating stories of pioneering spirit, of enterprise and resource and human interest in engineering reasearch, development, production, design, surveys and construction, etc.

Such a monthly column would, I believe, serve well to remind us that, as engineers, we are not merely builders of bridges, buildings and power plants but that we have a much wider responsibility towards the problems of mankind and the building of human progress.

Yours very sincerely,

(Signed) Edward C. Hay, m.e.i.c.

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*.

H. M. Jaquays, M.E.I.C., of Montreal, has been elected president of Ontario Steel Products Limited. Mr. Jaquays is vice-president of the Steel Company of Canada, Ltd., vice-president of the Occidental Fire Insurance Company, and a director of various other companies.

General A. G. L. McNaughton, C.B., C.M.G., D.S.O., M.E.I.C., has retired as Minister of National Defence. He has been appointed chairman of the Canadian section of the Canada-United States Permanent Joint Board of Defence, a post in which General McNaughton's experiences will be of great service.

Joseph T. Thwaites, M.E.I.C., Canadian Westinghouse electronics engineer, of Hamilton, Ont., has been awarded an illuminated certificate by the United States government in " appreciation of effective service ". The award, granted by the United States Office of Scientific Research and Development, is in recognition of Mr. Thwaite's part in helping to perfect secret radio devices for the R.A.F. and U.S. Signal Corps. Following his work in the United States, Mr. Thwaites was loaned to the British government to work with leading scientists there in combating the German V-bombs. He is a graduate of Queen's University in the class of 1925 and was employed by the Smart Turner Machine Company Limited and by the Wentworth Radio Supply Company Limited, both of Hamilton, before he became associated with Canadian Westinghouse Company.

J. J. Thwaites, M.E.I.C.

N. P. Taylor, M.E.I.C., formerly an assistant chief engineer of the Aluminum Company of Canada Limited, Montreal, in charge of mechanical engineering work, has recently been transferred to Aluminium Works Limited with headquarters in Montreal. He has been replaced by **M. E. Hornback,** M.E.I.C., who was formerly in charge of civil engineering work.

W. L. Pugh, M.E.I.C., who is employed as chief draughtsman with the Aluminum Company of Canada, in charge of the general engineering department draughting room, has been appointed an assistant chief engineer in charge of all civil engineering work including buildings and foundations. He will still retain charge of the draughting room along with his new duties.

News of the Personal Activities of members of the Institute

Lieutenant-Colonel W. A. Capelle, M.E.I.C., who has been attached to the Headquarters Engineering Staff, 1st Canadian Army Overseas, has recently returned to Canada.

George McKinstry Dick, M.E.I.C., formerly Technical Assistant to the Works Manager, has been appointed manager of engineering by the Canadian Ingersoll-Rand Company Limited with headquarters at the Company's works at Sherbrooke, Quebec. Mr. Dick's new duties will include the co-ordination and management of all phases of the Company's field and manufacturing engineering, product development and similar activities.

Born in Stirling, Scotland, George M. Dick came to Canada in 1913 and in 1915 joined the Canadian Ingersoll-Rand Company as an apprentice pattern maker. He was rapidly promoted to tool draughtsman and chief tool designer. During the First Great War, his efforts were devoted to the design of shell manufacturing machinery for use in connection with the large contracts for shells of various calibres which were undertaken by the Canadian Ingersoll-Rand Company. Many of these special shell machines were also built for other shell manufacturers.

In the fall of 1919 Mr. Dick left the Company temporarily to attend Bishop's College, Lennoxville, and McGill University. While at McGill he won the Babcock-Wilcox and the Douglas Scholarships for Third and Fourth years and the Pulp and Paper Association, the Engineering Institute and the Crosby prizes for summer essays, also the British Association medal upon graduation as a Bachelor of Science in mechanical engineering in 1924. During the summer periods, he was employed by the engineering departments of the Brompton Pulp & Paper Company, Babcock-Wilcox and Goldie-McCulloch and Canadian Ingersoll-Rand Company.

In November, 1924, Mr. Dick returned to Sherbrooke as a draughtsman and designing engineer on mine hoists and hauling machinery, serving as chief hoist designing engineer from 1937 to 1941. During this period he travelled extensively, gaining wide experience in the design and construction of hoisting machinery and its application in Canadian mines and collieries.

In 1940 Mr. Dick was also appointed chief engineer of Sherbrooke Pneumatic Tool Company, the shell-making subsidiary of the Canadian Ingersoll-Rand Company, in which position he had complete engineering responsibility for the design of machinery for making 4.5 and the modern 5.5 howitzer shells.

In November, 1941, Mr. Dick was appointed manager of No. 2 Manufacturing Division with responsibility for shop management, production planning and other duties related to the manufacture of air compressors, mine hoists, condensers, marine engines and special products for the Armed Forces. In December, 1942, Mr. Dick was appointed technical assistant to the works manager at Sherbrooke and remained in this capacity until his appointment as Manager of Engineering.

Fraser S. Keith, M.E.I.C., has been appointed vice-president and special executive officer of the Canadian Forestry Association. It will be his task to organize co-operation in public forest policy on the part of the boards of trade and other business groups and to bring associations of manufacturers, rural municipalities, professional societies and similar groups into a working partnership with the Canadian Forestry Association for the advancement of forest conservation. Mr. Keith was for 20 years manager of the department of development, industrial and public relations, Shawinigan Water and Power Company, Montreal.

F. S. Keith, M.E.I.C.

Dr. Ferdinand Kraft, M.E.I.C., formerly in charge of the Kipawa Mill research department, Canadian International Paper Co., at Temiskaming, Que., has taken over the duties of chief chemist with the Marathon Paper Mills of Canada who are at present erecting a large sulphate plant at Marathon, Ont.

Eric R. Jacobsen, M.E.I.C., has recently joined the United States Steel Export Company with the title of sales engineer. This company handles all the export business of the various companies which make up the United States Steel Corporation. For some time at least, Mr. Jacobsen will be located at headquarters in New York. He was formerly assistant director general of the Australian War Supplies Mission in Washington. On several occasions he was acting head of the organization and in 1943 led a special mission to Australia. Before going to Washington three and a half years ago, he was employed as a designing engineer with Dominion Bridge Company and a part-time member of the Faculty of Applied Science at McGill University.

Since leaving Canada, Mr. Jacobsen has contributed regularly to the *Journal* under the heading of " Washington Letter ", and in this issue his " New York Letter " appears.

Adrien Genest, M.E.I.C., has been awarded one of ten fellowships in traffic engineering at Yale University. The fellowships, made possible through a grant to the Bureau of Highway Traffic by the Automotive Safety Foundation, enable recipients to engage in a full academic year of graduate study in traffic engineering and individual transportation research at Yale.

Mr. Genest, who is an assistant engineer in the Public Works Department, City of Montreal, has been granted a year's leave of absence to study at Yale, where his course will deal with advanced engineering phases of highway operation and provide opportunity for original research on problems affecting city street and traffic improvement.

William H. Stuart, M.E.I.C., manager of the Halifax branch of the War Assets Corporation for the past year, has been appointed Deputy Minister of Highways and Public Works for Nova Scotia, filling the vacancy caused by the resignation last year of R. W. McColough, M.E.I.C.

W. H. Stuart, M.E.I.C.

Mr. Stuart was born in Cheltenham, England, but moved to the United States at an early age. He later came to Canada and received his early education in Manitoba. He commenced his engineering studies at the University of Minnesota, but discontinued them to join the armed forces in 1914. He served in France for two years with the Canadian Army during the first world war, returning to Canada in 1919 to become resident engineer on Canadian National Railways construction in western Canada. In 1926 he became engineering superintendent in the C.N.R. hotel department, with headquarters in Montreal, a position he filled for eight years. During this period the railway extended its hotel chain by building the Nova Scotian Hotel, Pictou Lodge and the Charlottetown Hotel.

In 1934 Mr. Stuart was given leave of absence to engage in metallurgy and mining. He was connected with the brass industry during the following year, and reported on transportation and hydro-electric development in northern mining areas for the Dominion during 1936-37. For the next two years, as a member of a contracting firm, he was in charge of construction of golf courses, waterworks, bridges and buildings in the national parks of the Maritimes. After joining the Royal Canadian Air Force in 1940, Mr. Stuart was given leave of absence to become manager of the Stanley Flying Training School, operated as part of the British Commonwealth Air Training Plan. When the school was closed in August, 1944, he became manager of the Halifax branch of War Assets Corporation.

H. J. Lemieux, M.E.I.C., who has been employed for the past two years in the engineering department of the Aluminum Company of Canada Limited at Arvida, Que., is now plant engineer for National Granite Limited at St. Joseph d'Alma, Que. Mr. Lemieux is at the same time carrying on a private practice as consulting engineer, specializing in reinforced concrete.

Gérard Beaulieu, M.E.I.C., has entered private practice as consulting engineer in Montreal. A graduate of Ecole Polytechnique in the class of '36, Mr. Beaulieu spent one year on mechanical design with Plessisville Foundry and eight years on structural design with Dominion Bridge Company Limited in Montreal. A few months ago he was appointed lecturer in structural steel design and bridges at Ecole Polytechnique.

E. A. G. Colls, M.E.I.C., of the Consolidated Mining and Smelting Company of Canada Limited at Trail, B.C., has been made manager of the chemicals and fertilizer division of the company.

H. O. Peeling, M.E.I.C.

Herbert O. Peeling, M.E.I.C., has been appointed plant manager of the two plants in Hamilton, Ont., of the Canadian Westinghouse Company, Limited. After graduating from the University of Saskatchewan in 1934, Mr. Peeling served one year with the Saskatchewan Power Commission prior to joining Westinghouse. During the past ten years he has occupied various engineering posts with the company.

Wm. W. Ramsay, M.E.I.C., recently retired from the Canadian Active Army, has accepted the appointment of hydraulic engineer with the Manitoba Department of Mines and Natural Resources with headquarters in Winnipeg, Man.

A. B. Normandin, M.E.I.C., of Quebec, has been appointed vice-president of the Provincial Electricity Board. He was formerly a commissioner of the Quebec Public Service Board.

Alex Larivière, M.E.I.C., a commissioner of the former Quebec Public Service Board, has been appointed vice-president of the Provincial Transportation and Communication Board of Quebec.

Alphonse Trudel, M.E.I.C.

Alphonse Trudel, M.E.I.C., has been appointed a member of the Provincial Electricity Board of Quebec. This organization, together with the new Provincial Transportation and Communication Board, replaces the former Quebec Public Service Board. Mr. Trudel was previously employed with Shawinigan Chemicals Limited at Shawinigan Falls, Que. He is a graduate in mechanical engineering of McGill University in the class of 1937. Mr. Trudel was secretary-treasurer of the St. Maurice Valley Branch of the Institute until last June.

F. A. Athey, M.E.I.C.

F. A. Athey, M.E.I.C., who has been employed for the past four years in the nylon division of Canadian Industries Limited at Kingston, Ont., has been transferred to 'Ducilo S.A.' Buenos Aires, Argentina, as plant manager of a new nylon plant to be built there. Ducilo is a DuPont and Imperial Chemicals subsidiary and an associate of C.I.L.

E. M. Nason, M.E.I.C., has resigned from the Canadian National Railways and has accepted the position of assistant city engineer in St. Catharines, Ont.

E. B. Wardle, M.E.I.C., consulting engineer of the Consolidated Paper Corporation, Grand'Mere, Que., has retired from active work with the company. He is now residing in Meriden, Connecticut, but will continue to serve in a consulting capacity with the Corporation.

Lieutenant R. H. Timms, Jr.E.I.C., who has been released from the R.C.N.V.R., has now returned to his former position as vice-president of R. Timms Construction Limited, general contractors and builders, at Welland, Ont.

Lieutenant D. Lorne Lindsay, Jr.E.I.C., was the designer of the adaptation of a new anti-aircraft gun intended to give Pacific-bound Canadian ships greatly improved protection against Japanese suicide air attacks. After graduating in mechanical engineering from McGill University in 1941, he enlisted in the R.C.N.V.R. and spent some months on *H.M.S. Curacao* based at Rosyth, Scotland. He later took a gun mounting course and returned to Canada. He was posted to Ottawa as inspector of gun mounting with the staff of the director of naval ordnance at Naval Service Headquarters.

H. B. Abells, S.E.I.C., who graduated this year from the University of Manitoba with the degree of B.Sc. (Elect.), is now employed by the National Research Council as a junior engineer in the division of physics and electrical engineering.

David P. Cottingham, S.E.I.C., is now employed in the engineering service department, apparatus division, at the head office of the Canadian General Electric Company at Toronto, Ont. He is a graduate of the University of Manitoba in the class of '44.

Robert L. Ménard, S.E.I.C., a recent graduate of Ecole Polytechnique with the degree of B.A.Sc. in civil engineering, is now in the hydraulic service, Department of Lands and Forests, Province of Quebec, at Quebec City.

Flight Lieutenant E. B. A. Le Maistre, S.E.I.C., of Montreal, has been awarded the Distinguished Flying Cross. The citation reads as follows: "Flight Lieutenant Le Maistre has completed two tours of operational duty. During the second tour he has operated chiefly in light Liberators and has taken part in several attacks on enemy submarines, often in the face of intense opposition. On one occasion Flight Lieutenant Le Maistre's aircraft was attacked by four Junkers 88's over the Bay of Biscay, but by skilful evasive action he shook them off. On another of his missions he descended to a very low level in the face of fierce anti-aircraft fire to examine a new type of armed trawler. He has at all time shown great courage and devotion to duty".

Sub-Lieutenant E. M. Tuff, S.E.I.C., graduated from Nova Scotia Technical College in May of this year with the degree of B.Eng. (Elect.). He was selected as a technical officer with the R.C.N.V.R. and is at present stationed at *H.M.C.S. Naden*, Esquimalt, B.C.

Marcel Bellefeuille, S.E.I.C., who recently received his degree of B.A.Sc. in civil engineering at Ecole Polytechnique, Montreal, has accepted a position with the Inventions Board, National Research Council, Ottawa.

ERRATUM

In the August issue of the *Journal* it was incorrectly reported that **J. A. deBondy,** M.E.I.C., was no longer with the Manitoba Steel Foundries, Limited. Mr. deBondy is still associated with this firm and has recently been transferred from Selkirk to Winnipeg, Man.

Obituaries

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

George Roderick MacLeod, M.E.I.C., former assistant chief engineer of the City of Montreal, died suddenly on August 27th, 1945, at his home in Montreal, Que. Born at Uigg, Prince Edward Island, on September 23rd, 1872, he attended Prince of Wales College in Charlottetown. In 1897 he graduated from McGill University with a B.Sc. in civil engineering.

For two years after graduation he was assistant superintendent at McGill College Observatory and in 1899 became associated with the Grand Trunk Railway in Montreal, as assistant engineer. In 1901 he was made resident engineer and in the following year was appointed secretary to the vice-president. After two years spent with the reconnaissance surveying department, Mr. MacLeod became an assistant to the vice-president. He also served for a short period as divisional engineer of the Grand Trunk Railway in Toronto and was responsible for the reconstruction and maintenance of 1,500 miles of railway. In 1907 he joined the Great Northern Railway at St. Paul, Minn., working for a few months as assistant chief engineer and later as assistant to the vice-president.

In 1908-09 Mr. MacLeod was assistant secretary of the Canadian Society of Civil Engineers. For the next four years he worked as managing engineer of the McGuigan Construction Company in Toronto, and in 1913 returned to Montreal as engineer in charge of railways, bridges and tunnels for that municipality. From 1915 until 1918 he also served as superintending engineer of the sewer department in addition to his other duties. In 1918 he became chief engineer of the technical service, a branch of the Department of Public Works of the City of Montreal which was organized at that time, with the purpose of concentrating in one department all the engineering work connected with every branch of the city public services with the exception of water supply and distribution. Under Mr. MacLeod's direction this engineering service developed to rank amongst the largest and most important engineering organizations in Canada. In 1929 he was appointed assistant chief engineer of the City of Montreal. This appointment, the first in the City to be made to that title, enabled Mr. MacLeod to devote his attention to the preparation and co-ordination of all projects leading to the improvement of the metropolis. In 1931 he was entrusted with all questions relating to railways and tramways in Montreal, including the supervision of the construction of bridges, tunnels and viaducts. In 1938 he retired from service with the City. In 1941 he received an appointment to the engineering staff of No. 3 Air Training Command, Royal Canadian Air Force, in Montreal, and for the past three years was on the engineering staff of the aircraft department, Canadian Vickers Limited, now Canadair, at Cartierville, Que.

During the last two years of the first world war, Mr. MacLeod served as secretary to the chairman of the Canadian War Mission and Imperial Munitions Board, Washington, D.C. In 1919-20 he was treasurer of the University Settlement of Montreal and for the two years following held the position of president of that organization.

Mr. MacLeod joined the Institute as a Student in 1897, transferring to Associate Member in 1908 and to Member in 1914. He was made a Life Member in 1939. He took an active part in the affairs of the Institute for many years, having served as councillor representing the Montreal Branch from 1922 until 1927 inclusive and as vice-president in 1929-30. He had served on several committees and for a number of years was chairman of the Institute's Committee on Legislation and By-laws.

Alfred James Towle Taylor, M.E.I.C., prominent British Columbia engineer, died in New York, N.Y., on July 19th, 1945, after an illness of several months.

Born at Victoria, B.C., on August 4th, 1887, he received his education in that city. After working successively for Canadian General Electric, Hamilton Powder Works, Canadian Explosives Limited and other industrial firms he became president and managing director of Taylor & Young Limited, consulting and contracting engineers, in 1912. Two years later he was president and managing director of the Taylor Engineering Company in British Columbia and during the next eight years carried through over seven million dollars worth of industrial engineering undertakings, comprising steam power plants, marine design and construction and industrial town sites. Subsequently he went to Toronto, then to England and Sweden, developing the manufacture of marine boilers. During this period he served successively as president of the Combustion Engineering Corporation Limited in Canada, as managing director of the Underfeed Stoker Company of London, England, and managing director of Ruth's Steam Accumulators Limited of London. In 1924 he was the English-speaking representative of the Anglo-Japanese Commission to Sweden and in the following year he conducted a party of Canadian and American engineers on a tour of inspection of plants of Sweden and Germany.

Ten years ago Mr. Taylor returned to Vancouver with plans for the development of his native province. He had succeeded in interesting foreign capital in B.C. investments and brought back ten million dollars of British money to buy West Vancouver taxlands and convert them into British Properties Limited. He promoted the construction of the famous Lions Gate Bridge and many splendid structures stand to-day as monuments to his creative skill. He had recently been investigating two other projects, that of Elk Falls at Campbell River and the plan to build a scenic highway from West Vancouver to Garibaldi Mountain. He was endeavouring to have the shopping centre of West Vancouver remodelled along modern lines and had blueprints ready for a yatching basin west of the Indian Reserve.

During the past four years Mr. Taylor served as a volunteer adviser for Britain in Washington, D.C. He was principal operating deputy for the British Purchasing Commission, assisting successively Lord Beaverbrook, Mr. Morris Wilson and Sir Henry Self. His war service was little known because of the essential secrecy of his operations. One of his tasks was to solve a shortage in torpedoes when they were needed most to cope with a renewed U-boat war in the North Atlantic two years ago. Mr. Taylor succeeded in getting United States factories working on a co-ordinated schedule for British sizes of torpedoes which differed from American patterns.

His work necessitated frequent trips by air across the Atlantic and on one of these about two years ago he received an injury from which he never fully recovered.

Mr. Taylor joined the Institute as a Member in 1927.

Alfred Ayre Mellor, M.E.I.C., vice-president of The Nichols Chemicals Co. Limited, Montreal, died on May 11th, 1945, at Montreal.

Born at Manchester, England, on October 13th, 1878, he attended Victoria University in Manchester and the University of Birmingham, graduating with the degree of M.Sc. in engineering with honours. He was connected with several engineering and contracting firms in England and, on his coming to Canada, was employed as assistant to C. L. Hervey, consulting engineer, in Montreal. In 1918 he became associated with The Nichols Chemicals Co. Limited in Montreal and remained with that firm until his death.

Mr. Mellor was the father of Major J. H. Mellor, Jr.E.I.C., of the R.C.E.M.E., and of Flight-Lieutenant A. G. Mellor, Jr.E.I.C., of the R.C.A.F., both of whom are on active service.

Mr. Mellor joined the Institute as an Associate Member in 1909, becoming a Member in 1940.

Andrew Walker, M.E.I.C., died on July 30th, 1945, at the Ross Memorial Pavilion of the Royal Victoria Hospital, Montreal, Que. He was born at South Durham, Que., on May 7th, 1881, and educated in Montreal.

Mr. Walker was a pioneer in the electrical industry in Montreal. His first employment was with the Thomson Electrical Works as draughtsman and he remained with the firm for 44 years. At the time of his death he held the position of vice-president and chief engineer. During his service with the firm he was in charge of all construction work including complete electrical plants of various industries, of the design of induction motors, transformers, control apparatus and switchboards.

Mr. Walker joined the Institute as an Associate Member in 1910 and transferred to Member in 1925.

Robert Ambrose Strong, M.E.I.C., died at Ottawa, Ont., on August 28th, 1945. Born at Victoria, B.C., on October 7th, 1891, he graduated from the University of Illinois with the degrees of B.A. and B.Sc., in 1915.

During the three years after graduation he was employed as assistant chemist and metallurgist with the Dominion Bridge Company, Lachine, Que. Early in 1918 he went overseas with the Royal Canadian Engineers and on his return the following year joined the staff of Dominion Copper Products Co. Ltd., as foreman of copper refinery. After a few months he became associated with the Lignite Utilization Board as acting chemical engineer and made important studies in western Canada for the Board. He was known as an engineering expert on coal carbonation. In 1924 he transferred to government work as engineer with the Bureau of Mines, Department of Mines and Resources, at the fuel testing station at Ottawa, Ont. Early in 1940 he was loaned by the Bureau to the Department of Munitions and Supply as consultant to the Munitions Contract Branch and shortly after was appointed director of the Branch. He remained in this position until his death.

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

Joseph Bernard Edouard Fabre Surveyer, Affil.-E.I.C., died on June 18th, 1945, at the Private Patients' Pavilion of the Montreal General Hospital after a brief illness. He was the son of Dr. Arthur Surveyer, M.E.I.C., past-president of the Institute.

Born at Montreal, Que., on August 20th, 1915, he was educated at Mount St. Louis College in Montreal, later attending the Rensselaer Polytechnic Institute at Troy, N.Y., where he studied industrial engineering. In 1937 he joined the staff of the Aluminum Company of Canada Limited, working first at Shawinigan Falls and later at Arvida, Que. In the eight years he was connected with the company he specialized in industrial safety and industrial and public relations. In January of this year he joined the Montreal Tramways Company as executive assistant, which position he held at the time of his death.

Mr. Surveyer joined the Institute as an Affiliate in 1939.

News of the Branches

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

SAGUENAY BRANCH

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

Soil and the Engineer was the topic chosen by Professor R. F. Legget of the University of Toronto, for his paper presented to the Saguenay Branch, on Wednesday, July 25, 1945.

In the absence of the chairman, the speaker was introduced by F. T. Boutilier, vice-chairman.

Professor Leggett defined soils from the engineer's point of view as " the unconsolidated material of the earth's crust ". He indicated the manner in which the various branches of engineering were concerned with soil. Professor Leggett pointed out that the agricultural engineer was concerned from the point of view of drainage, tillage, and farm equipment. The ceramic engineer is concerned almost entirely with clay and clay products. The mechanical engineer is interested in the tractive effort of automotive equipment and in foundations for stationary machinery. The electrical engineer has to deal with tower footing foundations, equipment grounding, and more recently, with geophysical prospecting. The chemical engineer encounters soils and the construction of chemical plants; and the mining engineer is sometimes confronted with earth moving problems, an example of which is in Northern Quebec where the prospect was discovered under thirty feet of overburden. There is also the Steep Rock Iron Mine, where the lake had to be drained and the silt removed before the mining proper could be started. The civil engineer is concerned with soil movement in construction of highways, roads, bridges, docks, etc.

The speaker stated, that except for isolated cases, the study of soil has taken place within the past twenty years, and the term " soil mechanics " was first used at Harvard in 1936.

A detailed study of soil conditions was brought about chiefly by the advent of the automobile, and the subsequent highway programme, beginning about 1919.

Professor Legget described how rock, by successive grinding, could be reduced to gravel, sand, silt, and to a material of one micron or less, which was called clay. This material, however, when analyzed, was found to have properties very different from those of real clay, which was produced by weathering. The development of X-ray diffraction during the past ten years has made it possible to analyze various clays according to their mineral contents and atomic structure. It is due to this atomic structure that certain clays absorb large amounts of water, and therefore expand, giving source to considerable trouble in roadbeds. The stabilization of these clays by waterproofing the crystals has been carried on in the States and in Canada, by mixing the clay with about two per cent of bitumen. Prior to the war experiments had been carried out in Germany on stabilization by electric means.

The speaker then covered some of the features of the survey made in 1941 at the site of the Shipshaw power plant.

Three outstanding features of the study were that, first, in the overburden the clay was on top of the sand and gravel; secondly, the clay when analyzed, was found to be silt, which is less stable when disturbed than in its original condition; and thirdly the evidence of water action. Pot holes were discovered at elevations differing by 200 ft., and one of these pot holes was 8′ 6″ in diameter and 15 ft. deep, indicating a tremendous flow of water at some stage in the history of the region, and it was believed that they had been formed during the glacial period, as large waterworn cavities were found at different elevations, separated by rock ridges.

At site of Dam No. 5 the overburden consisted of ten feet of sand and gravel; two feet of organic material; and another ten feet of sand and gravel. In the organic material were found perfectly preserved specimens of various types of wood, as well as shells of fresh water clams. An analysis of the pollen in the organic material showed that the ancient forest had consisted of 67 per cent white pine, indicating that the climate at the time the deposit was formed differed over the present climate by at least ten degrees. One explanation of this deposit is that the original sand was deposited by back water from the melting glaciers. As the waters receded, the forest grew up and deposited the organic material. The waters then rose again fairly quickly, killing the forest, and depositing the additional ten feet of sand and gravel.

On behalf of the Branch, A. Cunningham thanked Professor Legget for his paper.

Library Notes

BOOK REVIEW

ENGINEERING PREVIEW

An Introduction to Engineering Including the Necessary Review of Science and Mathematics. By L. E. Grinter, Harry N. Holmes, H. C. Spencer, Rufus Oldenburger, Charles Harris, R. G. Kloeffler, V. M. Faires. Toronto, The Macmillan Company of Canada, 1945. 619 pp., 6 x 9 in., $7.50

Reviewed by S. R. Banks, M.E.I.C.*

The conception of this book sets out to give the student a broad idea of the basic sciences upon which the complex and constantly-expanding art of engineering has its foundation. He will find in its pages a recapitulation of his high-school work in those sciences, together with a general survey of the technical field into which he will enter should he elect to become a chemical, electrical or mechanical engineer. It may be assumed that the reader's continued interest in the book (particularly if it leads him to apply himself to the "Comprehensive Examination" that is included) should provide a fair indication that he is engineer-minded. A simpler preliminary aptitude-test is also propounded.

The idea is ambitious: but the field that the authors (all of whom are of high academic standing) have to cope with is a vast one, and the limitations of space are inexorable. The coverage of the main chapters (which deal respectively with Outlines of Engineering and Science, Chemistry, Technical Drawing, Mathematics, Light and Electricity, Mechanics, and Thermodynamics) is consequently wide rather than deep; while the effort to sustain the student's interest causes emphasis to be placed on somewhat arbitrarily-chosen facets of knowledge.

Engineering Preview (the name is rather ambiguous, and might with advantage to the reader be supplemented by a subtitle such as "The Technologist's Background") conforms to the nature of an elementary engineering handbook; and, like many handbooks, it has faults both of omission and commission. Thus, for example, those who aspire to the traditional kinds of civil engineering will be disappointed by the omission of the fundamental subjects of hydrostatics and geology; and also by the absence, in the section on drafting, of any reference to structural steelwork or reinforced concrete. And there will be some who, like the present reviewer, regret that the inspiring theme of professional ideals is dealt with so briefly. From the other viewpoint one may wonder why it was considered advisable to present so complete a disquisition on the use of the slide-rule, and also to expend some fifty valuable pages in the reproduction of ordinary mathematical tables.

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, Etc.

Carbon Dioxide:
Elton L. Quinn and Charles L. Jones. N.Y., Reinhold, 1936. 9¼ x 6¼ in., 294 pp., illus.

Introduction to Practical Radio:
Durward J. Tucker. N.Y., Toronto, Macmillan, 1945. 8½ x 6 in., 322 pp., illus.

Thermodynamic Properties of Air; including Polytropic Functions:
Joseph H. Keenan and Joseph Kaye. N.Y., Wiley, c1945. 73 pp., tables.

U.S. College Graduate:
F. Lawrence Babcock. N.Y., Macmillan, 1941. 9½ x 6¼ in., 112 pp., tables.

PROCEEDINGS, TRANSACTIONS, REPORTS, ETC.

Alberta, University. Dept. of Civil Engineering:
Report of the Proceedings of the First Refresher Course in Soil Mechanics and Concrete, January 1945, (180 pp. approx.), mimeo.

American Institute of Electrical Engineers:
Transactions, v 63, 1944.

American Institute of Mining and Metallurgical Engineers:
Directory, 1945

American Society for Testing Materials:
Proceedings, v 44, 1944.

American Society of Civil Engineers:
Transactions, v 109, 1944.

* *Aluminium Laboratories Limited, Montreal.*

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

Association of Professional Engineers of Nova Scotia:
Year Book, 1944.

British Columbia, University:
Calendar, 1945-46.

Canada. Dept. of Labour:
Wage Rates and Hours of Labour in Canada, 1943. Report No. 26.

Chimie & Industrie:
Technologie, 1944, Vol. 52, Nos. 1-6.

Columbia University. Dept. of Nursing of the College of Physicians and Surgeons:
Announcement, 1945-46.

Engineering College Research Association:
Directory of Member Institutions and their Principal Fields of Research, 1944.

Mount Allison University:
Calendar, 1945-1946.

Queen's University. Faculty of Applied Science:
Calendar, 1945-1946.

Research Council of Alberta:
Annual Report, 1944.

Toronto Harbour Commissioners:
Annual Report, 1944.

Toronto, University. Engineering Society:
Transactions and Year Book, 59th, 1945.

TECHNICAL BULLETINS, Etc.

American Institute of Electrical Engineers:
American Standard Definitions and General Standards for Wire and Cable. Approved A.S.A. Dec. 12, 1944. A.I.E.E. No. 30, 1944; A.S.A. C8.1—1944.
American Standards for Graphical Symbols for Telephone, Telegraph, and Radio Use. Approved A.S.A. Nov. 4, 1942. A.S.A. Z32.5—1942.
American Standard Insulator Tests. Approved A.S.A. Sept. 7, 1944. A.I.E.E. No. 41, 1944; A.S.A. C29.1—1944.
Standards for Fuses above 600 Volts. A.I.E.E. No. 25, Mar. 1945. Recommended Specification for Speed Governing of Prime Movers Intended to Drive Electric Generators. Published for One Year Trial Use. A.I.E.E. No. 600, July 1944.
Report on Aircraft D¾C Apparatuc Voltage Ratings. Proposed A.I.E.E. Standard for One Year's Trial Use. A.I.E.E. No. 700, Mar. 1945.

Canada. Dept. of Mines and Resources. Surveys and Engineering Branch. Geodetic Service of Canada:
Precise Levelling in Quebec North of St. Lawrence River by R. H. Montgomery. Ottawa, 1945.

Canadian Affairs:
House on the Hill by George Hambleton. Vol. 2 No. 10, July, 1945.

Canadian Legion Educational Services. Let's Consider Jobs:
Engineering. Group Discussion Series, No. 4—(2), 1945.

Codes of Practice Committee:
British Standard Code of Practice:
CP (B) 479-1945.—Gas Lighting—Single Family Dwellings. CP (B) 480—1945.—Flues for Gas Appliances. CP (B) 481—1945. —Internal Plastering. CP (B) 482—1945.—Preparation of Surfaces to Receive Plaster. CP (B) 483—1945.—Lime Plastering. CP (B) 484—1945.—Cement Finishes.

Electrochemical Society:
Preprints:—
87-34 Electrochemical Processes in the Manufacture of Electronic Devices by A. Koroelak.

Forest Research Institute, Dehra Dun:—
Indian Forest Leaflet No. 77—1945—
Preliminary Studies on Improved Wood, Pt. 3—Compregnated Wood.

Ohio State University. Engineering Experiment Station: Bulletin:—

No. 122.—Load Distribution over Continuous Deck Type Bridge Floor Systems by W. S. Hindman and L. E. Vandegrift.

Circular:

No. 47.—Ohio's Mineral Resources; 3 Salt (in 2 parts) by Samuel P. Hildreth, W. R. Harris and E. J. Corell.

U.S. Dept. of the Interior. Bureau of Mines:

Miners' Circular:—

No. 47.—Accident Statistics as an Aid to Prevention of Accidents in Bituminous-Coal Mines.—Coal-Mine Accident-Prevention Course, Section 1.

Technical Paper:

No. 677.—Detonators: Initiating Efficiency by the Miniature-Cartridge Test by R. L. Grant and J. E. Tiffany.

PAMPHLETS

Abstracts on Utilization of Sawdust:
Muriel E. Whalley. Ottawa, National Research Council, 1945. (N.R.C. No. 1285).

Canada's Merchant Seamen:
Hon. Lionel Chevrier. Ottawa, King's Printer, 1945.

Canada's Pulp and Paper Industry; a review of its Growth, Production and Exports:
Ottawa, Dept. of Trade and Commerce, 1945.

Canada's Role in Atomic Bomb Drama:
Ottawa, Minister of Reconstruction, 1945.

Electrochemical Society:
Constitution and By-Laws, April 1945.

Engineers Return to Civil Life:
Engineering Institute of Canada, 1945.

Fundamentals of Industrial Electronics:
Canadian General Electric Co. (Reprint of a series of articles by G. M. Chute which appeared in Steel, April 3 to May 22, 1944).

How Electronic Tubes Work:
Canadian General Electric Co., 1945.

How to Train Your Assistants:
Richard W. Wetherill. National Foremen's Institute, 1945.

International Trade, Foreign Investment and Domestic Employment including Bretton Woods Proposals:
Committee of Economic Development, 1945.

Let's Make a Fresh Start:
A. Brown. Lethbridge, Lethbridge Herald Press, 1945.

Light from Floors:
N.Y., Universal Atlas Cement Co., 1945.

Milling Machine and Its Attachment:
Book 2 of Milling Practice Series. Milwaukee, Wis., Kearney & Trecker Corp., 1945.

Oil Seals for Rotary Shafts:
John Forrest. Cambridge, W. Heffer, 1945. (Reprinted from Transactions of the Institution of the Rubber Industry, Vol. 20, No. 6.)

On Demande des Ingénieurs Humanistes:
Louis Trudel. Montreal, Engineering Institute of Canada, 1945. (Reprinted from Collège et Famille, July 1945.)

Organization of the Engineering Profession:
James F. Fairman. N.Y., American Institute of Electrical Engineers, 1945. (Reprinted from Electrical Engineering, June 1945.)

Professional Employee in Applied Science and Research and Collective Bargaining:
Montreal, Quebec Federation of Professional Employees, 1945.

Projection of Canada:
Donald W. Buchanan. (Reprinted from University of Toronto Quarterly, Vol. 13, No. 3, April 1944.)

Radar:
British Information Services. Information Division, ID 611, June 1945.

Ralph Edward Flanders:
Seventh Hoover Medalist. N.Y., Hoover Medal Board of Award, 1945.

Reels and Coils for Cable Dimensions and Weights:
Aluminum Company of Canada, March 1945.

Role of Information:
Ottawa, Rehabilitation Committee, 1945.

S.P.E.E. and E.C.P.D. Initiate Cooperation in Professional Development:
Ivan C. Crawford and Chas. F. Scott. (Reprinted from Journal of Engineering Education, Vol. 35, No. 3, Nov. 1944.)

Should Family Allowances be Given to the Parents or to the Children
Leon Lebel. (Translated from the July, 1945, issue of Relations.)

Silver Jubilee History; 1920-1945:
Ottawa, Professional Institute of the Civil Service of Canada, 1945.

Steel Sheet Piling:
USS. Carnegie-Illinois Steel Corporation, Pittsburgh, 1942.

Unwritten Laws of Engineering:
W. J. King. Canadian General Electric Co. (Reprinted from Mechanical Engineering, May, June, July, 1944.)

Vacations with Work:
Robert F. Legget. Toronto, Univ. Dept. of Civil Engineering. (Reprinted from Journal of Engineering Education, Vol. 35, No. 8, April, 1945.)

We or They:
Louis K. Anspacher. Canadian Club of Montreal, 1944.

What the Foreman Needs for Success:
National Foremen's Institute, Deep River, Conn., 1945.

Will You Help?
N.Y., Engineers' Council for Professional Development, 1945.

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

AIRCRAFT ENGINES OF THE WORLD, 1945

Paul H. Wilkinson. N.Y., Paul H. Wilkinson; Toronto, General Publishing Co., 1945. 9¼ x 6 in., 352 pp., illus., $11.75 Canadian Funds.

The 1945 edition is the third volume of this authoritative international reference book. It contains complete up-to-date specifications of all the latest aircraft engines of the United States, Great Britain, Australia, France, Germany, Italy, Japan, and the U.S.S.R. The contents have been completely revised and much of the material is new. The revision is as of January, 1945. New features included consist of 37 new engines, the latest Japanese power plants, airborne auxiliary generating sets, and jet propulsion engines and gas turbines.

BUILDERS OF THE BRIDGE; the Story of John Roebling and His Son

D. B. Steinman. N.Y., Harcourt, Brace; Toronto, McLeod, 1945. 10¼ x 6¾ in., illus., 457 pp.

The author, one of the foremost bridge builders of our day, has devoted years to the study of the Roeblings and their times. The amount of research required to write the book was enormous. The material had to be gleaned from literally thousands of sources —original manuscripts, family letters, diaries, memoirs, notes, reports, periodicals, newspaper files, biographical works, scrap-books, technical literature, records of historical societies, and correspondence. Sometimes valuable human-interest items of this story were discovered in the most unexpected places—buried in printed documents and official reports that seemed dry, dusty, and formidable.

The book is authoritative, and at the same time extremely interesting and readable.

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.

AIR NEWS YEARBOOK, Vol. 2

Edited by P. Andrews. Duell, Sloan and Pearce, New York, 1944. 296 pp., illus., 9 x 12 in., cloth, $4.75.

Extensive chapters on the development and operation of the air forces of the principal world powers are illustrated by some four hundred photographs. Individual descriptive material is provided for all planes shown, and plane types are arranged according to the countries of their origin.

AMERICAN MALLEABLE IRON, a Handbook

Malleable Founders' Society, Union Commerce Bldg., Cleveland, Ohio, 1944. 367 pp., illus., diagrs., charts, tables, 9 x 6 in., fabrikoid, $4.00.

All phases of the malleable iron industry are covered in this handbook. The early chapters deal with its constitution and properties. Succeeding chapters take up casting and machining practice, manufacture and metallurgy. Nearly one hundred pages of engineering tables and data provide needed information. A brief history of the industry, a glossary, and a bibliography of source material are included.

CHEMICAL PROCESS INDUSTRIES

By R. N. Shreve. McGraw-Hill Book Co., New York and London, 1945. 957 pp., illus., diagrs., charts, tables, 9 x 5¾ in., fabrikoid, $7.50.

In this new text the author follows modern factory practice in breaking down the actual industrial procedures into unit operations and unit processes. Covering a broad range of subjects, the author utilizes over a hundred recently devised flow sheets as the framework around which much of the text is written. A list of selected references accompanies each chapter.

CHEMISTRY OF COAL UTILIZATION, 2 Vols.

Prepared by the Committee on Chemical Utilization of Coal, Division of Chemistry and Chemical Technology, National Research Council, H. H. Lowry, Chairman. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 1,868 pp., not including indexes, illus., diagrs., charts, tables, 9 x 6 in., cloth, $20.00 (2 Vols.).

Prepared by a staff of thirty-five contributors, this two-volume treatise constitutes a comprehensive and critical review of the voluminous but scattered literature on the scientific and practical aspects of coal utilization. Forty separate chapter subjects, covering a wide range from the origin of coal to the synthesis of hydrocarbons, are comprised in the more than 1,800 pages in the two volumes. In addition to the customary subject index to the volumes, a book index and name index are provided for the great number of literature references occurring in footnotes.

CUTTING TOOL PRACTICE

By H. C. Town and D. Potter. Paul Elek (Publishers) Ltd., Africa House, Kingsway, London, W.C.2, 1945. 131 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, 13s. 6d.

Recent developments in metal cutting tools are described for both single point and multi-cutting tools for high production work. Special topics covered include down-cut and negative rake milling, drilling of square and hexagon holes, specialized hobbing, and diamond tools. The characteristics of cutting materials are discussed with information on sharpening and heat treating practice.

DYNAMIC METEOROLOGY

By J. Holmboe, G. E. Forsythe and W. Gustin. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 378 pp., diagrs., charts, tables, 8½ x 5½ in., cloth, $4.50.

Intended as a basic introduction to theoretical meteorology, this text starts from the fundamental principles of physics and develops the tools of thermodynamics and hydrodynamics needed for the understanding of atmospheric motion. Only material which is considered indispensable for the practical meteorologist and weather forecaster has been included. A general knowledge of physics and calculus on the part of the student is assumed.

EBULLIOMETRIC MEASUREMENTS

By W. Swietoslawski. Reinhold Publishing Corp., New York, 1945. 228 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.00.

A comprehensive description is given of the ebulliometric method for measuring the boiling and condensation temperatures of liquids and solutions. Practical applications discussed include the determination of degree of purity of liquid substances, examining the azeotropy of binary and ternary mixtures, molecular weight work, microanalytical impurity determinations, boiling and condensation phenomena under high pressure, and the examination of physico-chemical standards. The expanded use of these methods in everyday industrial research is indicated by the author.

FUNDAMENTALS OF THERMODYNAMICS

By A. S. Adams and G. D. Hilding. Harper & Brothers, New York and London, 1945. 289 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $3.75.

The object of the authors is to give the beginning student an understanding of the fundamentals of thermodynamics adequate for further related study in mechanical engineering, physics and chemistry. Separate chapters are devoted to compressed air, the Otto and Diesel cycles, and steam cycles. Many worked-out practical examples are included.

INDUSTRIAL ORGANIZATION AND MANAGEMENT

By L. L. Bethel, F. S. Atwater, G. H. E. Smith and H. A. Stackman, Jr. McGraw-Hill Book Co., New York and London, 1945. 798 pp., illus., diagrs., charts, tables, 9 x 5¾ in., cloth, $4.50.

Management as a field of specialization within itself, rather than as an adjunct to the study of engineering or business, is the subject of this basic text. It prepares the student for advanced work in methods, cost, industrial relations, budgeting, production control, marketing, office management, etc. There are four principal sections: American industry (historical); organizing the industrial enterprise; operating the enterprise; coordinating the enterprise.

INDUSTRIAL PLASTICS

By H. R. Simonds. 3 edit. Pitman Publishing Corp., New York and Chicago, 1945. 396 pp., illus., diagrs., charts, tables, 9¼ x 6 in., linen, $5.00.

The use of plastics as engineering materials is emphasized in the full treatment of the fabrication as well as the basic manufacturing processes of plastics. Important new developments and processes are covered in this revised edition, which also devotes a chapter to foreign practice. Design information, suggestions for new applications and markets, and a revised trade name index provide further useful material for the student or practical user.

MAKING PATENT DRAWINGS

By H. Radzinsky. The Macmillan Company, New York, 1945. 96 pp., diagrs., tables, 10¼ x 7¼ in., cloth, $3.00.

Explicit instructions are given for shading, placement of numerals and figures, and other special techniques in making drawings both for patents and for trademarks. Brief general drawing instructions are included, and a separate chapter is devoted to common causes for rejection. The rules of the U.S. Patent Office relative to drawings are appended.

MASTERS OF MASS PRODUCTION

By C. Borth. Bobbs-Merrill Co., Indianapolis and New York, 1945. 290 pp., illus., 8¾ x 5¾ in., cloth, $3.50.

In narrative form the author first briefly presents the early efforts of American inventors and manufacturers who played their parts in the development of the system currently known as mass production. The major part of the book is devoted to the characteristics, methods and achievements of the men who applied this mass production, under pressure of the War, to the manufacture of the new weapons, vehicles and planes needed. The feeling of the whole book is—this is America in action.

MERCHANT MARINE AND WORLD FRONTIERS

By R. E. Anderson. Cornell Maritime Press, New York, 1945. 235 pp., illus., diagrs., charts, 9 x 6 in., fabrikoid, $3.00.

The opening chapters of this book discuss the importance of shipping to foreign trade and to the general economic situation. The history of our Merchant Marine during World Wars I and II is presented with a picture of its decline between wars. Considerable space is devoted to the monumental tasks faced and accomplished during the present conflict, and to the postwar problems to be solved, for which the author provides answers from his own wide experience.

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 606*)

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

August 30th, 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 October 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 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

ANGERMAN—JAROSLAW KAZIMIERZ, of 1470 Fort St., Montreal, Que. Born at Jaslo, Poland, July 13th, 1898. Educ.: M.S. (Elec. Engr.), Politechniki Lwowskiej, Lwow, Poland, 1929 (academic status guaranteed by Assn. Polish Engrs. in Canada); 1926-27, designer, Poliskie Zaklady Siemens, Katowice, Poland; 1927-28 designer, Giesche Ska Akc, Katowice, Poland; 1928, designer, Skodove Zavody, Plzen, Czechoslovakia; 1929-37, chief engr., Polskie Zaklady Skody, Warszawa, Poland; 1937-38, chief engr., Rohn Zielinski, Brown Boveri Co., Warszawa, Poland; 1938-39, chief engr., Polskie Zaklady Siemens, Warszawa, Poland; 1941 to date, designer for A. C. motors and generators, Montreal Armature Works ,Ltd., Montreal.

References: L. A. Wright, J. Pawlikowski, D. Goldwag, J. S. Korwin-Gosiewski.

EDGEWORTH—THOMAS GEORGE, F/O. ,R.C.A.F., of Moncton, N.B. Born at Tate Creek, B.C., March 7th, 1922. Educ.: B.Sc. (Chem.), Queen's Univ.,.1943; with Ford Motor Co., Windsor, Ont., as follows: 1941, (4 mos.), mechanical dftsman., 1942, (4 mos.), testing laboratories; with R.C.A.F., as follows: 1943-45, navigation instructor with rank of P/O, then advanced to rank of F/O., and now awaiting posting to Far East as Navigator in Transport Command.

References: H. W. Harkness, A. Jackson, A. L. Clark, R. A. Low, V. C. Blackett.

FRATTINGER—PETER ANTHONY, of Ocean Falls, B.C. Born at Milwaukee, Wisconsin, Nov. 15th, 1908. Educ.: B.A.S.c, Univ. of B.C. 1933; R.P.E., B.C.; with Pacific Mills, as follows: 1931-36, millwright, Vancouver, B.C., 1936-40, mech. engr., Ocean Falls, B.C.; 1940-42, inspectg. officer, (materials), U.K.T.M.; 1942 plant engr., Ruberoid Co., Gloucester, N.J.; 1942-43, supt. prod., P.R.D.D.; 1943-45, plant engr., i/c all mech. and electrical mtce., and steam plant, Howard Smith Paper Co., Beauharnois, Que.; after Sept. 1st, 1945, plant engr., Pacific Mills Ldt., Ocean Falls, B.C.

References: P. E. Jarman, H. M. Lewis, R. H. Vaughan, C. W. E. Locke, A. D. Creer.

GRABILL—DAYTON LESLIE, of Town of Mount Royal, Que. Born at Montreal, Que., Oct. 31st, 1901. Educ.: B.A.Sc., Univ. of Toronto, 1924; Superior School of Mines, Paris, France, (post-grad. work); 1922, (summer), sampler Hollinger Mine, 1923, (summer), sampler and engr., Premier Mine; 1926-28, sales engr., W. S. Tyler Co., Cleveland, Ohio; with Mount Royal Dairies Ltd., as follows: 1928-33, plant supt., 1934-36, sales mgr., and asst. mgr.; 1937-42, genl. mgr. and vice-pres. and for almost 5 yrs., pres. and mgr. i/c plant operation, mtce, purchasing and sales, Brown-Buchanan Dairy Ltd., Montreal, Que.; 1942-43, (6 mos.), chief enforcement officer, National Selective Service, Dept. of Labour, Ottawa; 1943, (1 mo.), supvr. Approvals Div., W.P.T.B.; 1945, (3 mos.), sr. engr., Stevenson & Kellogg, Montreal; and at present, asst. to vice-pres., on prod. and development, i/c constrn. machinery processes, etc., for new large plant, Johnson & Johnson Ltd., Montreal, Que.

References: L. A. Wright, F. J. Friedman, L. Miller, F. R. McDonald, C. Morrison.

GREGG—ELWYN EMMERSON, of Victoria, B.C. Born in Huron County, Ont., May 13th, 1896. Educ.: B.A.Sc., Univ. of B.C., 1923; with British Columbia Forest Service, as follows: 1921, compassman, 1922, cruiser, 1923, chief-of-party, cruiser, 1924-27, jr. forester, 1927-32, asst. district forester, Prince Rupert, 1932-38, district forester, Prince George, 1938-41, asst. forester, Victoria, and to date, i/c Forest Protection and Operations Divn., all constrn. ranger stns., mech. equipt., forest protection plans, etc.

References: J. H. Blake, W. O. C. Scott, A. L. Carruthers, H. C. Anderson, G. M. Irwin, R. Bowering, E. Davis.

IRVINE—DANIEL JOHN SYLVESTER, Lieut. (E)., R.C.N.V.R., of Halifax, N.S. Born at Saskatoon, Sask., March 18th, 1917. Educ.: B.Sc. (Chem.), Univ. of Saskatchewan, 1941;with Inspection Bd. of U.K. & Canada, as follows: 1941, (2 mos.), chemist, Welland Chem. Co., Niagara, Ont., 1941, (1 mo.), chemist, D.I.L., McMasterville, Que., 1941, (9 mos.), shift supvr. & control chemist, testing government explosives and raw materials, Canada Car Munitions, Cherrier, Que., with R.C.N.V.R., as follows: 1943-44, (5 mos.) 2nd Engr., H.M.C.S. Swift Current, 1944 to date, Chief Engrg. Officer, H.M.C.S. Wallaceburg, c/o F.M.O., Halifax, N.S.

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

JOLLY—JOHN WILSON, of 358 Holland Ave., Ottawa, Ont. Born at Perth, Australia, April 5th, 1906. Educ.: Int. B.Sc., Univ. of London, 1924-27; R.P.E., Ontario; 1922-27, genl. work in plant on vacations and 2 mos. drafting on bearing applications, Skefko Ball Bearing Co., England; 1928-30, i/c machine tool & woodworking div., anti-friction bearings, constrn. machinery, calculation of loads, determination bearing life, preliminary design of mounting, housing, etc.; with Canadian SKF Co., Ltd., Toronto, as follows: 1931, (approx. 9 mos.) sales & service work, 1931, asst. to chief engr., duties substantially as in New York, but covered every type of machinery, service work on C.N. locomotives fitted with anti-friction bearings, 1933-38, transferred to newly formed Diesel engine divn., responsible for all engrg. work in connection with layout of installns. of engines and combined units, local modifications and service work, recommendations for marine and stationary plants; 1938:40, duties similar to above with Atlas Polar Co., Toronto, 1940 to date, inspectr. of fuzes, responsible for inspectn. fuze stores made in Canada, Inspection Bd. U.K. & Canada, Ottawa, Canada:

References: W. L. Batt, D. Giles, J. L. Bieler, J. E. Openshaw, J. W. Fagan, F. R. Pope, R. W. Brews.

MacKAY—FRANK HAMILTON, 135 Cathcart St., Sault Ste. Marie, Ont. Born at Virden, Man., June 17th, 1913. Educ.: B.Sc. (Elect.), Univ. of Man. 1936; R.P.E., Ontario; with Great Lakes Power Co., Ltd., Sault Ste. Marie, Ont., as follows: 1936-40, genl. hydro-elec. power experience in drafting, opern., mtce., and constrn., 1941 to date, asst. engr. on operation, mtce., constrn. power house, design and constrn. transmission line, design, incl. cost valuation, and constrn. distribution systems, meter and relay engrg., system short circuit study and analysis.

References: A. E. Pickering, R. A. Campbell, N.C. Cowie, E. M. MacQuarrie, A. M. Wilson.

WARD—ROBERT GRENVILLE DISTIN, F/L., R.C.A.F., Overseas. Born at Ont., June 11th, 1911. Educ.: B.Sc. (Elect.), Univ. of Alberta, 1935; 1934-35, (summers), surveying with late R. C. Laurie, D.L.S.; 1935-36, (8 mos.), worked on installn. steam turbine, Saskatchewan Power Commission; 1936-42, municipal engrg., for engr., City North Battleford, Sask.; with R.C.A.F., as follows: 1942-44, aeronautical engr.; 1944 to date, elect. engrg. officer.

References: E. S. Braddell, R. S. L. Wilson, R. M. Hardy, L. A. Thorssen, R. F. Morrison.

FOR TRANSFER FROM JUNIOR

BOULTON—CHARLES ALBERT, of Montreal, Que. Born at Ayr, Ont., Jan. 3rd, 1893. Educ.: B.Sc. Queen's Univ., 1917; 1918-19, with Murphy & Underwood, (cons. engrs.) Saskatoon; with E. G. M. Cape Co. as follows: 1920-25, constrn. engr.; 1926-40, constrn. supt.; 1941-45, genl. supt. on Canadian defence projects, Newfoundland. (Jr. 1917.)

References: E. G. M. Cape, J. B. Stirling, Alex Gray, W. H. Noonan, W. H. Slinn, R. L. Dunsmore.

FOR TRANSFER FROM STUDENT

DINSMORE—CLARENCE SHERMAN, of Merrickville, Ont. Born at Thornbury, Ont., Oct. 12th, 1919. Educ.: B.A.Sc., Univ. of Toronto, 1941; 1941-43, material control & planning, Federal Aircraft Ltd., Montreal; 1943-Apr. 1945, with Alloy Foundry Inc., Merrickville, asst. mgr., and from June, 1944, mgr.; at present, sec.-treas. & mgr., Granville Castings Ltd., Merrickville. (St. 1940.)

References: R. A. Young, W. A. Newman, C. R. Young, R. F. Leggett, C. F. Morrison.

SMALLWOOD—ROBERT EDWARDS, of Montreal, Que. Born at Sault Ste. Marie, Ont., Feb. 27th, 1913. Educ.: B.A.Sc. (Mech.) Univ. of Toronto, 1935; with Dom. Engineering Works Ltd., as follows: 1935-40, design work on transmn., mining, rubber mill, rolling mill machy., and sales engr. in branch office; 1940-41, plant supt. i/c iron foundry, machine shop and erection of diesel engines and hoist and shovel equipt.; 1941 to date, i/c design for transmission, rubber and plastics machy. and gear design. (St. 1935.)

References: J. G. Notman, H. S. Van Patter, H. G. Welsford, W. G. H. Holt, H. Crombie.

LIBRARY NOTES

(*Continued from page 604*)

NEW PLASTICS

By H. R. Simonds and M. H. Bigelow, assisted by J. V. Sherman. D. Van Nostrand Co., New York, 1945. 320 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, $4.50.

This book presents the available information on all important plastics materials developed since 1940. Separate chapters are devoted to the new fibers, new adhesives, new laminating materials, new applications of wood and paper, new forms and coatings. New and improved processes and applications for established plastics are covered, and the trend of the plastics industry is demonstrated as indicated by summarized statistical and technical information.

PRINCIPLES OF PHYSICAL GEOLOGY

By A. Holmes. Ronald Press Co., New York, 1945. 532 pp., illus., diagrs., maps, tables, 8¼ x 5¼ in., cloth, $4.00.

A broad preliminary survey of the subject is presented in Part I of this new textbook which includes descriptive chapters on the materials and architectural features of the earth's crust. Part II covers external processes and their effects, and deals with the action of wind, water, life forms, etc. Part III discusses earthquakes, volcanoes and other internal processes and their effects, with a final chapter analyzing the various theories of continental drift.

PRODIGAL GENIUS, the Life of Nikola Tesla

By J. J. O'Neill. Ives Washburn, 29 West 57th St., New York, 1944. 326 pp., illus., tables, 8¾ x 5¾ in., cloth, $3.75.

This book is chiefly concerned with Tesla's talent as an inventor. It describes not only his discoveries within the field of electricity, but his work in other fields as well. Giving full credit to his status as a brilliant engineer, it also portrays the eccentricities which almost equally set him apart from the normal run of human beings. As the book shows, both aspects were in evidence quite early in life.

READJUSTMENT OF MANPOWER IN INDUSTRY DURING THE TRANSITION FROM WAR TO PEACE, Research Report Series No. 71

By H. Baker. Princeton University, Industrial Relations Section, Princeton, New Jersey, 1944. 112 pp., tables, 9¼ x 6 in., paper, $1.25.

The material presented constitutes an analysis of the policies and programs presently under consideration by industry for absorbing the returning manpower after the war. The results of a large number of discussions with industrial, union and government executives are grouped under three headings: organization and extent of company planning; transitional adjustments in the present labor force; employment and reemployment of veterans.

REINFORCED CONCRETE AND MASONRY STRUCTURES

Edited by G. A. Hool and W. S. Kinne, revised by R. R. Zipprodt. 2 ed. McGraw-Hill Book Co., New York and London, 1944. 835 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $6.00.

This popular text has been thoroughly revised, making it again an up-to-date reference work on the design and construction of reinforced concrete and masonry structures.

SCIENCE IN PROGRESS, 4th Series (Society of the Sigma Xi devoted to the Encouragement of Research in Science, National Lectureships 1943-1944)

By W. R. Miles and others, foreword by L. L. Woodruff, edited by G. A. Baitsell. Yale University Press, New Haven; Humphrey Milford, Oxford University Press, London, 1945. 331 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.00.

This fourth volume of a series contains eleven reports by the investigators themselves describing work in pure science that is closely linked to advances in the science of war and the art of living. The wide range of topics includes research on nerve cells and impulses, magnetic approach to absolute zero, vacuum chemistry, blood derivatives, atom mechanics, and the psychological aspects of military aviation.

SIMPLIFIED DESIGN OF STRUCTURAL STEEL

By H. Parker. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 226 pp., diagrs., charts, tables, 8 x 5 in., fabrikoid, $2.75.

This is the fourth of a series of elementary books dealing with the design of structural members used in the construction of buildings. It treats of the design of the most common structural steel members—beams, floor framing, girders, columns—and includes separate chapters on riveted and welded connections. The book is mainly concerned with the proper, practical application of engineering principles and formulas, and the essential tables of structural data have been included.

STREAM SANITATION

By E. B. Phelps, with a chapter on Stream Microbiology by J. B. Lackey. John Wiley & Sons, New York; Chapman and Hall, London, 1944. 276 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $3.25.

The beginning chapter gives the physical characteristics of a typical stream from source to mouth. The following chapters discuss stream pollution with considerable emphasis on its biochemical aspects, and describe both natural and artificial methods of purification. The final chapter contains a classification of the numerous microorganisms found in streams and describes their habitats and life processes.

TREATISE ON THE MATHEMATICAL THEORY OF ELASTICITY

By A. E. H. Love. 4th ed. Dover Publications, New York, 1944. 643 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $3.95.

This standard, widely known treatise has been out of print for some time, and this republication will be welcomed by many engineers and physicists. It is an American reproduction of the latest English edition, complete in every respect, with the advantage of a greatly reduced price.

TREATISE ON THE THEORY OF BESSEL FUNCTIONS

By G. N. Watson. 2 ed. The Macmillan Co., New York; The University Press, Cambridge, England, 1945. 804 pp., diagrs., tables, 10¼ x 7¼ in., cloth, $15.00.

The mathematical aspects of Bessel functions are discussed with two main objects: the development of applications of the fundamental theory of functions of complex variables; the compilation of a collection of results which would be of value to the increasing number of mathematicians and physicists who encounter Bessel functions in their investigations. An extensive bibliography is included.

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

CHEMICAL ENGINEER, recent graduate is required by a company in the Montreal area engaged in the manufacture of pigments and binders for production control work. Apply to Box No. 3089-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 to act as instrumentman for a survey party in the Abitibi district. Salary would be between $175 and $200 a month. Apply to Box No. 3076-V.

CIVIL ENGINEERING GRADUATE with two or three years' experience is required by a university in Ontario to act as lecturer in civil engineering, particularly in elementary surveying and strength of materials. Apply to Box No. 3091-V.

ELECTRICAL

ELECTRICAL ENGINEER, preferably but not necessarily bilingual, is required to act as teacher of electrical theory in a school in the Montreal area. Apply to Box No. 3063-V.

ELECTRICAL ENGINEER is required to act as chief electrician to take charge of all plant electrical equipment, construction and installation, all electrical repairs and maintenance work in a modern plant near Calgary. A company-owned house will be available. Apply to Box No. 3084-V.

MECHANICAL

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 with general background, age 27-35, is required by a company engaged in the food business in the Toronto area to understudy a senior position. Work would involve keeping up with new methods, processes, etc., and plant maintenance. Initiative and good personality essential. Apply to Box No. 3059-V.

SEVERAL MECHANICAL ENGINEERS are required to act as representatives for a firm dealing in diesel and gasoline engines for industrial use. Candidates need not be graduates and should be between 25 and 30 years old. Salary would be about $250 a month. Apply to Box No. 3067-V.

SENIOR MECHANICAL DRAUGHTSMAN with considerable experience in mechanical design and detailing is required for the design of mechanism and detailing of machine parts for plant improvements. This is a temporary position at Shawinigan Falls and is worth between $200 and $275 a month. Apply to Box No. 3071-V.

MECHANICAL ENGINEER, age 25-35 years with some experience in testing metals is required to be engaged in the testing of tensile, compression, impact, fatigue and creep characteristics of certain alloys. This position would be in Kingston at a salary of between $200 and $300 a month. Apply to Box No. 3075-V.

MECHANICAL ENGINEER required as assistant engineer in meat packing firm with plants throughout Canada. Duties to consist of design and layout of steam, refrigeration, and processing equipment, and cost control work in steam and refrigeration production. Position available in Calgary at a salary of $195 to $240 per month depending on experience. Apply to Box No. 3082-V.

TWO MECHANICAL ENGINEERS are required as mechanical superintendents with leading meat packing plant. Duties consist of supervising the operation of steam, refrigeration and electrical equipment, and the maintenance of all buildings and equipment. Positions available at Vancouver and Regina. Would prefer men with experience on similar work, under 40 years of age. Salary $220 to $280 a month depending on experience. Apply to Box No. 3083-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.

MISCELLANEOUS

RECENT GRADUATE in engineering is required to act as technical assistant for a firm of patent attorneys engaged in important industrial work in the Montreal area. Apply to Box No. 3061-V.

SEVERAL SALESMEN are required in the Toronto area for parts for automobiles, trucks, buses, etc. Candidates need not be graduate engineers but should be between 25 and 30 years old and should have business and sales ability. Salary would be in the neighbourhood of $250. Apply to Box No. 3066-V.

PRODUCTION MANAGER, graduate engineer age 27-32, with some knowledge of machinery and ability to handle men, if possible some experience in refrigeration and preferably a veteran, is required for a small factory in the Montreal area. Salary would be in the neighbourhood of $350 a month. Apply to Box No. 3069-V.

SEVERAL DRAUGHTSMEN not necessarily graduate engineers, bilingual, are required for mapping in the province of Quebec. Apply to Box No. 3074-V.

FIELD SERVICE ENGINEER, qualified to give instruction in shops or clinics on automotive electrical systems, carburetion systems and fuel systems for the service department of a firm interested in covering the province of Quebec and the Maritime provinces. Should be fluently bilingual. Apply to Box No. 3077-V.

TWO CIVIL OR MECHANICAL GRADUATES, preferably with some experience in plant layout work are required by a firm in eastern Quebec. Work would involve draughting at first with complete control of a process after some months. Candidates should be 25-35 years old and salary would be about $200 a month. Apply to Box No. 3079-V.

ASSISTANT ENGINEER is required in the engineering and design division of a company manufacturing road machinery, paper mills and wood-working machinery. Candidates should have experience in foundry, forge and machine shop and structural steel and should be between 30 and 40 years old with ability to assume responsibility. Salary would be between $200 and $250 a month and the location would be in southern Ontario. Apply to Box No. 3080-V.

ARCHITECTURAL DRAUGHTSMEN are required by a new company in the Montreal area for general draughting in connection with work to be done for several different companies. Apply to Box No. 3081-V.

SEVERAL SALES ENGINEERS not necessarily graduates but with mechanical inclinations and good appearance, between the ages of 21 and 25, are required to be trained in Montreal by a firm engaged in the production of machine tools and machinery. Preference will be given to returned service men and salary would be from $150 a month up, depending on experience. Apply to Box No. 3085-V.

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

CHEMICAL

CHEMICAL ENGINEER. Young man about 25 years of age, preferably single because of travelling involved, and with experience of a year or more is required to become a sales engineer for an engineering firm in Montreal engaged in installation of acid resistant linings for pulp and paper machinery. The starting salary would be in the neighbourhood of $200. a month. Apply to Box No. 2970-V.

CHEMICAL ENGINEER (or experienced mechanical) is required to act as superintendent of a sulphite mill operated by a Canadian newsprint manufacturer. Some experience in sulphite department of a paper mill is essential. Preference will be given to a veteran. Salary would be between $300 and $375 a month, depending on experience. Apply to Box No. 2985-V.

PAPER MILL FOREMAN is required by a paper company in the St. Maurice Valley to learn paper-making. Preference will be given to an ex-service man and salary will be from $225 to $300 a month. Apply to Box No. 3022-V.

CIVIL

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 is required by a railway company in Montreal to act as an expert on structural steel and concrete as applied to buildings. This position is worth $3000. a year. Apply to Box No. 2951-V.

CIVIL ENGINEERS. Several graduate engineers, either civil or mechanical between the ages of 22 and 30 are required to start as structural steel draughtsmen with the opportunity of becoming structural steel designers and sales engineers. The starting salary varies with experience between $185. and $250. a month. Apply to Box No. 2961-V.

CIVIL ENGINEER, recent graduate is required by a railway company in Montreal for general draughting work in their track department. Apply to Box No. 2973-V.

CIVIL ENGINEER, graduate, with land surveyor's certificate between the ages of 25 and 30 is required to work with a firm of consulting engineers and land surveyors in south-eastern Ontario with eventual prospect of partnership. Starting salary would be $200 a month. Apply to Box No. 2980-V.

CIVIL ENGINEER graduate, about 40 years old, with some experience in structural steel, is required by a bridge company in Ontario as sales engineer and to represent the company to senior officials of other companies. Salary would be approximately $300 a month. Apply to Box No. 2981-V.

CIVIL ENGINEER is required to act as draughtsman on an immediate project involving work on a transmission line, railway spur, steam power station, etc. This position is with an engineering company in Montreal at a salary to be discussed with the candidate. Apply to Box No. 3009-V.

ENGINEER-SECRETARY—a young graduate engineer with some experience is required to act as secretary-treasurer of a board of trustees formed for the purpose of the improvement of a district in eastern Ontario, and to supervise the anticipated development of a townsite in the neighbourhood of a recently established mine. Salary will be between $200 and $250 a month. Apply to Box No. 3029-V.

CIVIL ENGINEER is required in eastern Ontario to act as transitman on railway maintenance work for a railway company. Salary is approximately $185. per month with expenses. Apply to Box No. 3036-V.

CIVIL ENGINEER, preferably discharged member of R.C.E., is required for preparation of estimates and general construction work with a small company in Montreal. The salary would be between $200. and $300. a month depending on experience. Apply to Box No. 3038-V.

ELECTRICAL

GRADUATE ENGINEER, electrical, mechanical or civil with two to three years' experience is required by a firm of specialists in scientific illumination to be trained to act as sales engineer for this firm. The training period will be spent in Toronto at $180. a month. Apply to Box No. 2905-V.

ELECTRICAL SALES ENGINEER for western firm specializing in engineering sales and service of all types of electrical machinery and similar equipment. The position would be permanent and on a salary basis. Applicants should state training, experience, age, nationality and availability. Apply to Box No. 2911-V.

ELECTRICAL ENGINEER, university graduate with general maintenance experience of not less than three years in any branch of sound engineering is required for the post of electrical maintenance supervisor. Salary for this position will be in the neighbourhood of $2400. a year and the location will be in Ottawa. Apply to Box No. 2949-V.

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.

MECHANICAL

MECHANICAL ENGINEER, preferably with some experience in the pulp and paper industry is required for draughting and design work with a pulp and paper company in the Lake St. John district at a salary of approximately $300. a month. Apply to Box No. 2941-V.

MECHANICAL ENGINEER with tool and die experience and extensive background in intricate work such as small dies, instrument fitting, gauges, etc., and some experience in installation work covering motors, pumps, tanks, etc., is required to act as mechanical design and maintenance supervisor of a motion picture laboratory. This position will be in Ottawa at a salary of approximately $3000. a year. Apply to Box No. 2950-V.

MECHANICAL ENGINEERS, over 35 years old, with good plant experience in production or design are required by a firm of industrial consultants in Montreal. Salary would be between $400 and $500 a month. Apply to Box No. 3005-V.

SEVERAL MECHANICAL ENGINEERS are required immediately by a firm of contractors for work in connection with the installation of water supply, refrigeration, piping, etc., on a new plant in eastern Ontario. Candidates should be between the ages of 28 and 35 and should have four or five years' industrial experience. Salary would be approximately $250. a month Apply to Box No. 3035-V.

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 three or four years' general experience and about 25 years old, is required for general investigational work, methods improvement, etc., in a large new factory in the Montreal area. Salary will be about $225. a month. Apply to Box No. 3049-V.

SEVERAL MECHANICAL ENGINEERS are required to act as sales engineers for stokers. Some experience in boilers and stoker work desirable but not essential. Candidates should be between 25 and 35 years old and bilingual. Salary will be about $225. a month. Apply to Box No. 3044-V.

TWO ASSISTANT PROFESSORS are required by a university in western Canada, one to specialize in machine design, the other for power plant design. Also a number of demonstrators and instructors, full-time and part-time are needed. Recent graduates will be considered for full-time work or for part-time teaching and part-time post-graduate study. Apply to Box No 3050-V.

MECHANICAL ENGINEER is required to become general superintendent of a machine shop in Montreal. Candidates should be between 30 and 35 years old and should have good shop experience. Apply to Box No. 3051-V.

PRODUCTION AND SERVICE ENGINEER, not necessarily a graduate, is required by a firm of boilermakers and ironfounders in southern Ontario to assist in the development of the manufacture of stoker equipment and later the servicing of it. Good practical experience essential. Apply to Box No. 3052-V.

MISCELLANEOUS

TWO WELDING APPRENTICES, young graduates, are required to work for a firm engaged in specialized welding jobs in the Montreal area. These men will start in the shop for a period of about six months and then proceed through a period in the draughting room into the field as sales engineers with good prospects for promotion for the right men. The salary during the training period will be the equivalent of the current shop rates. Apply to Box No. 2946-V.

STEAM PLANT ENGINEER or stationary engineer is required by a Canadian newsprint manufacturer to learn the pulp and paper business. Apply to Box No. 2986-V.

SALES ENGINEERS are required by a company in Montreal engaged in the manufacture of insulating materials. Candidates must have technical education and preferably some plant operating and sales experience. Conversational knowledge of French desirable. Salary would be $200-$225 a month plus commissions. Apply to Box No. 2993-V.

MINING ENGINEER to give lectures to first two years of geology in a university in New Brunswick. Candidates must be available by September 15, 1945. Apply to Box No. 2996-V.

EVERAL RECENT GRADUATES with good character and personality and general engineering background are required by an engineering company in Montreal to start on draughting or field work. Apply to Box No. 3009-V.

SEVERAL ENGINEERING DRAUGHTSMEN, preferably ex-service men 30 years or younger, are required by a Canadian newsprint manufacturer Salary would be between $160 and $250 a month depending on experience Apply to Box No. 3023-V.

MILL SUPERINTENDENT is required for a paper mill in Three Rivers, preferably but not necessarily a graduate engineer discharged from the armed forces, with native talent and ability to handle miscellaneous jobs and men. Age between 25 and 30. Salary will be $225. to $250. a month depending upon experience. Apply to Box No. 3042-V.

SALES ENGINEER, graduate engineer, preferably but not necessarily, in electrical, is required by a firm engaged in the manufacture of all outdoor electrical equipment. Candidates should be about 25 years old, bilingual, and preference will be given to discharged service man. Salary will be between $150. and $225. depending on experience and the location will be in the Toronto area. Apply to Box No. 3046-V.

ARCHITECT OR GOOD ARCHITECTURAL DRAUGHTSMAN wanted by a large firm with head office in Saint John, N.B. This is a permanent position. Apply, stating references, etc., and salary expected to Mr. V. O'Neil, 98 Wright Street, Saint John, N.B.

Situations Wanted

MECHANICAL ENGINEER, Canadian graduate, age 45, married with eighteen years experience in foundry, machine shop, structural fabrication and assembly work, seeks a responsible position in this field. Accustomed to handle executive responsibilities and with a proven ability to secure the co-operation of others. Apply to Box No. 251-W.

SALES ENGINEER, Mechanical engineer, M.E.I.C., P.E.Q., age 39, experienced in general machinery, boilers, pumps, mechanical equipment of buildings, etc., some sales experience, desires position as sales engineer with headquarters in Montreal, with progressive firm manufacturing or handling varied range of equipment. Apply to Box No. 270-W.

ELECTRICAL ENGINEER, B.Sc., McGill '31, currently holding responsible supervisory position in government war agency, available on short notice. Interested in inspection, plant engineering and management. Prefer remaining in Montreal area. Apply to Box No. 626-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., R.P.E., in B.C., 40 years of age, married, 8 years' experience as superintendent and field engineer on construction including skeleton steel, reinforced concrete and timber structures. Some experience in taking off quantities and in design of water distribution systems. Eleven years' experience in supervisory and managerial positions in manufacturing. At present engaged as factory manager in the manufacture of a line of engineering products. Seeking a permanent position in a well-established organization where there will be greater scope for my abilities. Will be available on reasonable notice, under W.B.T.P. regulations. Applyto Box No. 880-W.

CIVIL AND MINING ENGINEER, M.E.I.C., R.P.E., age 44 married; employed by D.N.D.(N) for 3 years as maintenance and construction engineer on permanent works and buildings; experience includes eight years as chief surveyor with important mining company and ten years general engineering on construction of storage dams, hydro-electric developments, railways, roads, townsites and land surveys. Seeks a responsible position in construction or mining industry. Available on short notice under W.B.T.P. regulations. Apply to Box No. 901-W.

MECHANICAL ENGINEER, M.E.I.C., age 27, B.Sc. and B.E. (Mech.). Experienced as works engineer of large manufacturing plant. For the last two years with the R.C.E.M.E., in charge of installation, maintenance, inspection and administration of the mechanical, electrical and optical fire control equipment of entire Canadian East coast. Not available until released from Army but wishes to make contacts for post-war position. Apply to Box No. 2307-W.

CIVIL ENGINEER, Jr.E.I.C., age 31, married, temporarily employed by Naval Service; four years general experience including road construction, draughting and design, purchasing, six years in government service, past four as resident engineer on Naval Base construction; desires position leading to purchasing work with large industrial or contracting company; location immaterial. Available on one month's notice. Apply to Box No. 2504-W.

EXECUTIVE ENGINEER available. Graduate in mining, M.E.I.C., age 36, married. With experience in engineering sales work, road and paving construction, miscellaneous engineering, building construction, plant engineering; responsible for steam and water plants, water and sewage works, electrical power distribution, maintenance of plant buildings and miscellaneous process equipment. Experience in cost accounting, designing and estimating. Administrative experience as assistant manager of munitions plant. Capable of handling men. Apply to Box No. 2508-W.

GRADUATE CIVIL ENGINEER, age 32, presently serving in R.C.A.F., wishes to establish contacts with a view to rehabilitation in the near future. Ten years' experience in engineering work, five of which were in an executive capacity. Interested in position with general contractors or industrial firm. Would prefer position with British Columbia company or as representative in B.C. for eastern concern. Apply to Box No. 2515-W.

CIVIL ENGINEER, Jr.E.I.C., age 25, B.Sc. Alberta, 3 years on highway location and construction, 2 years building construction and maintenance; desires contacts in construction or industrial field for employment in near future. At present engineer works officer, R.C.E., Location immaterial. Apply to Box No. 2521-W.

MECHANICAL ENGINEER, M.E.I.C., R.P.E. (Que.) and B.Sc. McGill, married, 45 years old. Experienced in plant design, layout and construction. Seventeen years in construction, owning own business and five years in munitions manufacture. Experienced business manager and executive. Available now for responsible position. Apply to Box No. 2526-W.

GRADUATE MECHANICAL ENGINEER, S.E.I.C., R.P.E.(Ont.), graduate of Nova Scotia Technical College, 1943, age 25, married. Two years as Sub Lieut. and Lieut.(E) R.C.N.V.R., engineer draughtsman and estimator on complete naval fuelling base layouts, tankage, piping, pumping stations and wharf facilities. Also six months of heating and plumbing layouts for naval buildings. Honorably discharged, March, 1945. Presently employed as heating engineer with contracting firm installing heating and plumbing facilities in fifteen story hospital building. Desire permanent connection with opportunities for advancement. Available under W.B.T.P. regulations. Location immaterial if living accommodations available. Apply to Box No. 2532-W.

GRADUATE CIVIL ENGINEER, Jr.E.I.C., in B.C., 30 years of age, married, experience mostly mechanical; 5½ years oil refinery construction, maintenance, laboratory and processing, one year aircraft inspection. Past three years as assistant engineer with firm engaged in the manufacture of naval instruments, in charge of fine pitch gear manufacture and plastic molding. Apply to Box No. 2533-W.

CHEMICAL ENGINEER, age 28, single, desires position with responsibility and good future prospects. Applicant has one year's experience in research and development, 3 years in production and administration, and is a qualified instructor of job instruction training, job methods training, safety and job evaluation. At present engaged as area supervisor of production. Immediately available under W.B.T.P. regulations. Apply to Box No. 2534-W.

MECHANICAL ENGINEER, B.A.Sc., Tor., age 27, married, some experience in aircraft shop engineering including stress analysis and more extensively in shop engineering, estimating and production layout work with large electrical manufacturing company. Applicant has good organizing ability and could best serve in a production engineering capacity preferably with a small manufacturing company in Ontario. Apply to Box No. 2535-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., age 28, with 5 years' experience in large plant operation, design and construction, and executive training and experience in safety engineering, desires position with industrial concern in construction, building supplies, plant operation or safety engineering. Applicant will be available October 1st, 1945, or thereafter. Apply to Box No. 2536-W.

Chemical Engineers and Research Personnel Wanted

Large manufacturer of pulp and paper in eastern Canada has openings for the following:

Chemical Engineers for Process Control
Research Chemists (Ph.D.)
Research Mechanical Engineer

Previous experience in manufacture of pulp and/or paper not essential. Salaries according to qualifications. When applying give in detail training and experience also references. An interview will be arranged with all expenses paid. Apply to Box No. 3068-V.

Graduate Mechanical Engineer

The Eagle Pencil Company, Drummondville, Que., requires the services of a graduate mechanical engineer with at least three years' experience, bilingual, age preferably 25 to 35. Duties and responsibilities of position will be to work under direct supervision of plant manager and be responsible for executing prepared production schedules, performing manufacturing operations at lowest possible costs, maintaining quality in accordance with set standards, keeping all equipment in operating condition and inducting and training new employees. The right man can eventually become superintendent. Salary to be discussed with applicant. Apply in person or by writing.

ELECTRICAL ENGINEER

A growing company engaged in the manufacture of electrical motors and the like of small and medium size, is interested in the services of an engineer conversant with the design and construction of D.C. machinery. Although the position is not immediately vacant, it is hoped that it will be the case within the next two or three months. Familiarity with small and medium motors of the series traction type such as are used on cranes and haulage equipment an advantage. Job would be interesting and permanent for first-class man and a first-class salary would be paid. Apply to Box No. 3064-V.

Assistant Erection Superintendent

Large structural steel fabricating company requires an assistant erection superintendent. Work includes field erection of buildings, bridges, cranes and miscellaneous industrial equipment. Successful applicant must have had at least five years experience in this class of work. Engineering graduate or equivalent preferred. This is a permanent position with excellent prospects for advancement. Apply in writing only, stating age, marital status and full details of qualifications, to Box No. 3086-V.

Industrial News

Industrial development—new products—changes in personnel—special events—trade literature

FIRMS CHANGE NAMES

A new name has now been adopted to replace three names formerly used in different parts of the country by three companies which, for many years, have actually been one business family. Known as Geo. W. Reed & Company in Montreal, as The Metallic Roofing Company in Toronto, and as Western Steel Products Corporation in Winnipeg, the union that has long existed in fact, is to be known as Westeel Products Limited. Plants and offices are located at Montreal, Toronto, Winnipeg, Regina, Saskatoon, Calgary, Edmonton and Vancouver.

RECENT APPOINTMENT

Appointment of James R. Warren as chief engineer for Rogers Majestic Limited, Rogers Electronic Tubes Limited and other subsidiary companies, is announced by W. G. Robertson, vice-president in charge of manufacturing and engineering.

Mr. Warren has had extensive experience in all phases of electronic production. For several years he has been with Research Enterprises Limited, in charge of engineering development of radar equipment, and of tube development and production. His work for R.E.L. took him on a number of trips to Britain in connection with the technical development of radar and other electronic equipment for marine and aerial navigation and operation. For some years previously he was connected with Canadian Westinghouse.

NEW BRANCH FACTORY

R. G. LeTourneau Inc., of Peoria, Ill., manufacturers of heavy grading equipment, have announced plans to establish a branch factory in England to better serve the equipment needs of earthmovers there and on the European continent.

Brig. W. E. R. Blood, in charge of the British Army Engineers' headquarters at Washington, D.C., is managing director designate of the new branch. Serving as plant manager will be Maurice Foote, promoted from superintendent of LeTourneau plant No. 1 at Peoria.

NEW PLANT

A new one-storey, streamlined surgical dressing plant is being built by Johnson & Johnson on a 55-acre tract of land on Notre Dame Street East, Montreal.

This new plant, with no partitions and an unobstructed floor area of 187,000 sq. ft., will embody the ideas of General R. W. Johnson, chairman of the board of the world-wide parent company. Straight-line production will be an important feature, with equipment laid out so that, in the manufacture of its products, raw material will move in a straight line through to the finished products and then to the loading docks. There will be roads around all four sides of the building and a railway siding into the plant. Doors on every side will enable trucks to draw up and load or unload goods with the least effort. In addition there will be many modern features to assure cleanliness, efficiency and ideal working conditions.

Architecture and engineering are under the supervision of Ross & Macdonald, with A. Leslie Perry as associate architect, and McDougall & Friedman as consulting engineers. Construction is being done by A. F. Byers & Co. Ltd.

Lt.-Col. M. A. Buell

RETURNS TO ROOFERS SUPPLY

Lt.-Col. M. A. Buell is now back with The Roofers Supply Co. Ltd., Toronto, after serving with the Royal Canadian Engineers for the past five years. He is in charge of advertising and in the sales division. Lt.-Col. Buell went overseas in the summer of 1940 and returned to Canada on an instructional tour in 1943. He then attended the Staff College at R.M.C., Kingston, and was appointed C.R.E., 6th Canadian Division.

INGLIS ENTERPRISE

In announcing a new enterprise of John Inglis Co. Ltd., to be known as the "Special Products Division", A. L. Ainsworth, vice-president and general manager, states the operating of this division will be the responsibility of W. A. Hill as general manager and Willard Scott, sales manager.

Mr. Hill was formerly general superintendent of the Inglis Company's ordnance division; Mr. Scott was recently associate director of National Selective Service, Department of Labour, and previous to that in the automotive field.

The new division will make available to Canadian industry the most modern precision production facilities supplemented by the engineering, metallurgical and other technical knowledge available in the company for engineering and manufacturing of components, sub-assemblies and completed units.

DECEASED

Joseph George Beare, who was connected with Link-Belt Limited since 1922, died suddenly on July 21st at his home in Toronto. He had been in charge of Link-Belt advertising in Canada and served as managing editor of the company's house magazine, "Transmitting & Conveying Ideas", and also was treasurer of the Ontario division of the National Industrial Advertisers Association.

DOMINION OXYGEN EXPANSION

Plans for the construction of an oxygen filling station adjoining the acetylene-generating plant of their affiliate, Prest-O-Lite Co. of Canada Ltd., at 733 Tache Avenue, St. Boniface (Winnipeg), Man., have just been announced by Dominion Oxygen Co. Ltd., a unit of Union Carbide & Carbon Corporation.

At the present time a sales office; a warehouse for the distribution of Union Carbide, Unionmelt automatic electric welding apparatus and supplies, and Oxweld oxy-acetylene welding, cutting and flame-treating apparatus and supplies; and an apparatus repair station are located at the site of the acetylene plant. The erection of the oxygen filling station will provide a convenient point for supplying one of the company's main products to industries in this area.

RETURNS TO POSITION

Lt.-Col. Thomas A. Beasley has returned to Minneapolis-Honeywell Regulator Co. Ltd., as resident sales engineer in Hamilton, to cover all Niagara Peninsula territory.

Lt.-Col. Beasley joined the company in 1933 as sales engineer. He saw service in the 1st World War and from then on was connected with the militia. He went on active service again in August, 1940, serving first as Major-in-charge of the Artillery Institute, Hamilton district. This was followed by his promotion to Lieutenant Colonel and he was placed in charge of recruiting and training for the Hamilton, Brantford, Dundas and St. Catharines Batteries.

NEW ADDRESS

It has just been announced by J. R. Longstaffe, president of Copper Wire Products Limited, that this company has purchased the factory at 137 Oxford Street, Guelph, Ont., and will begin operation there on November 1st of this year.

Copper Wire Products Limited manufacture transformers for the radio and electrical industry, as well as electrical coils of all types. They are also the sole licensee in Canada for Jensen speakers and reproducers and will manufacture a complete line of these here in Canada.

This company has been operating four plants in Toronto which will now be consolidated in Guelph in the one building, which contains 35,000 sq. ft.

Key personnel will be brought from Toronto, including E. G. Hall, general manager and secretary-treasurer; Arthur Edney, plant superintendent; Jack Prestwich, office manager and Alex Bow, chief technical adviser.

BALDWIN PRODUCTS

According to a recent announcement an arrangement has been made between the Baldwin Locomotive Works of Canada, Limited, and United Steel Corporation Limited, whereby the latter will manufacture Baldwin products in Canada and for the British Empire, including hydraulic presses, turbines, power machinery, water wheels and other lines of special equipment. *(Continued on page 54)*

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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2050 MANSFIELD STREET - MONTREAL

CONTENTS

COVER PICTURE

The cover picture shows semi-permanent Bailey Bridges built across the Neder Rhine at Arnhem, Holland, by Royal Canadian Engineers. In the background may be seen the bridge blown out by the retreating German Army. *(Canadian Army Overseas Photo)*

ERRATUM

August Cover Picture

The description of the cover picture, appearing on the Contents Page of the August issue, is erroneous. The photograph shows fractionating towers where is produced one of the chief components of 100-octane aviation gasoline. The equipment is part of the plant of Montreal Alkylate Operators Limited and is entirely located within the Shell Oil Refinery at Montreal East.

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SEMI-PERMANENT BRIDGE CONSTRUCTION BY CANADIAN ARMY

In the European Theatre of Operations

COLONEL J. P. CARRIÈRE, M.E.I.C.
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Introduction

In planning the invasion of Western Europe by the Allied Expeditionary Forces, provision was made for the eventual crossing of the Rhine River into Germany, but the initial plans provided only for ferries and for assault bridges.

During November 1944, it became evident that the assault across the Rhine River and its tributaries in Holland might have to be carried out at a time of the year when major floods are most likely to take place; in addition, air photographs and other sources of information revealed that all bridges were either prepared for demolition or demolished. (See Fig. 1).

It was therefore decided to build permanent bridges at selected sites on the main highway and railway crossings as soon as possible after the assault to restore communications under all conditions.

The purpose of this paper is to describe the planning and construction of two typical crossings and to give some insight into the problems which face the military engineer under battle conditions.

Design Specifications

The specifications laid down by higher commands, from Supreme Headquarters Allied Expeditionary Forces (SHAEF) down to Army Headquarters may be summarized as follows:

(a) *Datum*—The datum to be used at all bridges to be the mean of the three greatest average high stages of the rivers, taken from available records of water levels from 1896 to 1938 and to be called "SHAEF datum level".

(b) *Navigation*—A navigation gap of 75 ft. minimum width with a clearance of 22 ft. above SHAEF datum level to be left in each bridge.

(c) *Levels*—Bottom chord level of bridges to be 17 ft. minimum above SHAEF datum level at spans other than the navigation spans.

Deck level to be 23 ft. 11 in. above SHAEF datum level throughout at all bridges.

(d) *Traffic Layout*—Each bridge to be one way only; "up route" being that leading towards Germany and "down route" being that leading back from Germany to our own lines and rear bases.

(e) *Widths and Load Classifications*—

(i) All "up bridges" to be Class 70 capacity and have a minimum width of roadway 10 ft. 9 in. between wheel guides.

(ii) All "down bridges" to be Class 40 capacity and to have a minimum width of roadway 12 ft. 6 in. between wheel guides.

(iii) Through bridges to have a minimum clear width of 12 ft. 4 in. between the inside edges of trusses.

(iv) Decked bridges to have a minimum clear width of 15 ft. 4 in. between the inside edges of guard rails.

Note—Description of military highway bridge load classification is given in graphical form, in Fig. 2.

(v) Footwalks for pedestrian and cyclist traffic to be erected on each side of each bridge providing a minimum width of 4 ft. 11 in. between handrail and bridge members.

In addition to the above, headquarters of First Canadian Army laid down that transportation of bridging stores to the various bridge sites be kept off the main army maintenance routes and floating bridges as much as posisble.

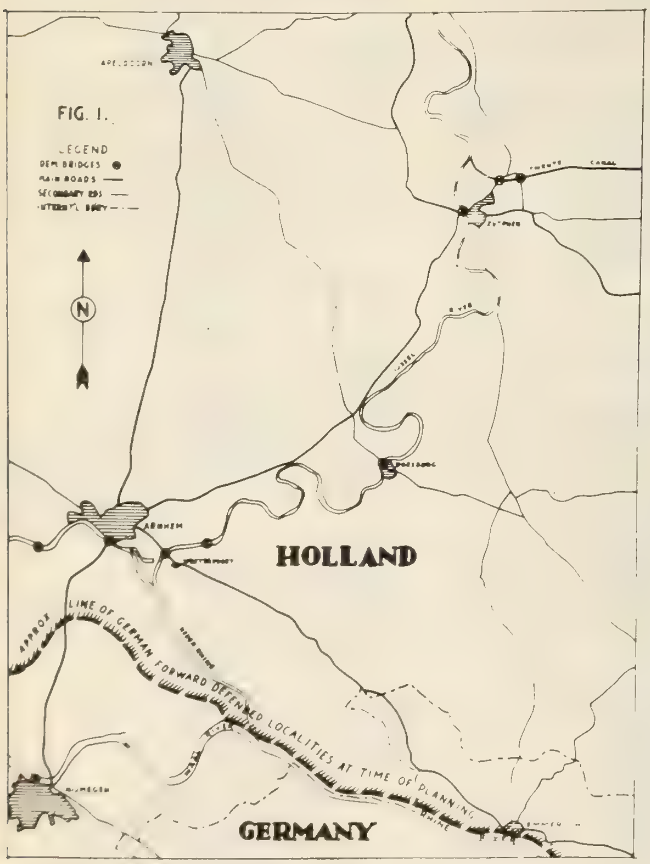


Fig. 1

Preliminary Planning

Information for preliminary planning was obtained from air photographs, military maps and Rhine River survey plans and records supplied by Dutch authorities. Much useful information was found in a copy of the proceedings of the Dutch Institution of Civil Engineers relating to the construction of the original highway bridge at Arnhem.

Tentative bridge sites were selected from air photographs; in both cases these sites were upstream from the demolished highway bridges.

At this time, the bridge sites were still in German hands, however the approximate data listed in Tables

I and II were assembled and used as a basis for preliminary planning and design.

Records suggested that highest high water level may occur at any time of the year, and that the water may rise to its maximum high level in two to three days.

Preliminary planning also revealed that the transport facilities which could be depended on for the movement of stores and plant were as follows:

(a) *Rail*—Nijmegen, which was then being organized to be the hub of First Canadian Army operations, is an extensive railway centre. Railway lines leading from rear areas were being repaired and sidings were being put in. Arrangements were therefore made to reserve railway space for bridging stores, plant and materials coming from rear areas as far forward as possible. An allotment of 600 tons per week was made tentatively to permit detailed planning.

(b) *Road*—From rear areas forward, up to Nijmegen, the main roads had been maintained in good shape and maintenance crews were being kept on these to repair any possible damage without delay.

Secondary roads were not in very good shape but could accommodate some traffic at reduced rate of speed.

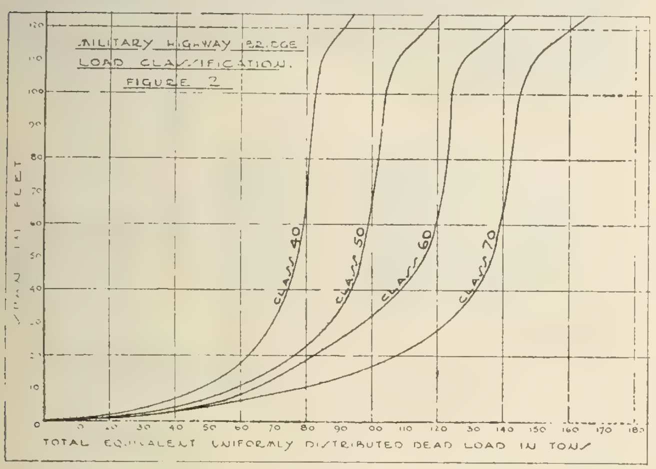


Fig. 2—Military highway bridge load classification.

From Nijmegen forward, First Canadian Army plans provided for the development of one two-way main route into Germany via Arnhem and Zutphen, along the west bank of the river Ijssel; this route, which appeared to be the best from information at hand, had the disadvantage of a narrow and winding section between Nijmegen and Arnhem which, coupled with the necessity of crossing temporary bridges at Nijmegen and at Arnhem, suggested possible slowing down of traffic.

Another route was planned from Nijmegen into Germany by way of the Hochwald and Reichswald forests, Cleve and Emmerich; this would be a secondary route, single way for most of its length and consisting of rapidly built gravel and " corduroy " paths through the forests.

(c) *Water*—The Rhine and its tributaries are navigable throughout under normal conditions, but at this stage of the war many man-made obstructions existed; those which were of immediate interest as regards the transport of stores for the Arnhem and Zutphen bridges were:

(i) The demolished Arnhem highway bridge blocking the Neder Rhine at Arnhem.

(ii) The demolished Westervoort highway and railway bridges blocking the entrance to the Ijssel river from the Neder Rhine.

(iii) The demolished highway bridge at Doesburg on the Ijssel river.

(iv) The demolished highway and railway bridges at Zutphen also on the Ijssel river.

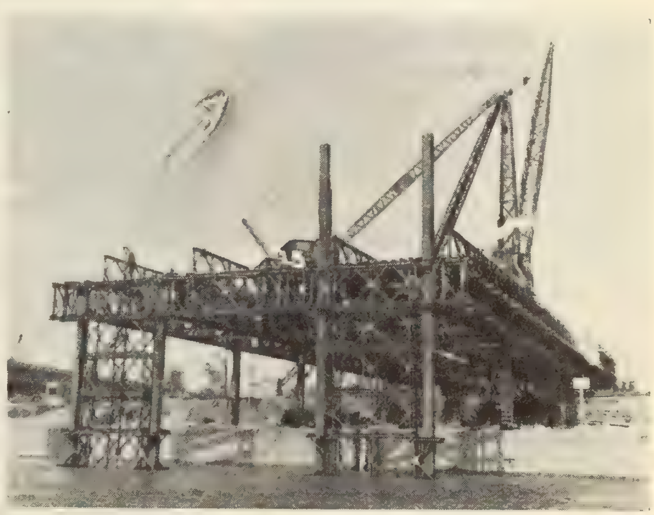
Unloading 50 ft. and 60 ft. timber piles—note transporter built specially for this task.

TABLE I

Location	Width of Wet Gap (ft.)	Width of Flood Plain (ft.)	Length of Approaches (ft.)	
Zutphen (Site 1)......	335′	555′	260′	220′
Zutphen (Site 2)......	335′	505′	290′	200′
Arnhem (Site 1)......	640′	650′	475′	450′
Arnhem (Site 2)......	640′	650′	475′	450′

TABLE II

Detail	Elevations (in ft.)	
	Zutphen	Arnhem
Gauge Zero..............	0.0	0.0
Shaef Datum.............	20.67	34.74
Highest High W.L.........	±29.0	±44.0
Highest Nav. W.L.........	±20.0	±35.0
Lowest Low W.L..........	±10.0	±10.0
Shaef Datum + 17′........	37.67	51.74
Shaef Datum + 22′........	42.67	56.74
Level of Old Bridge Approaches............	29.6 (Min.)	45.0 (Min.)



General view of first bent at Arnhem showing two piles driven in place and two piles pitched and ready to be driven.

North approach of Arnhem bridge before official opening.

Detailed examination of air photographs suggested that the removal of debris of the Westervoort bridges would take four to five weeks and consequently the possibility of moving stores on the Ijssel was ruled out. At Arnhem, unloading facilities existed upstream of the demolished bridge which suggested that stores could be moved by water from Nijmegen to Arnhem.

Many Rhine River barges and tugs had been captured at Nijmegen and could be used for this purpose; these barges were of 500 to 700 tons capacity and approximately 200 to 300 ft. long.

On the basis of the above information, a tentative stores transport plan was made as follows:

(i) Move all stores except long piles from rear areas by rail to Nijmegen.

(ii) Move all long piles from rear areas by road to Nijmegen. (Suitable vehicles to be provided for this purpose.)

(iii) Operate a central bridge stores dump at Nijmegen.

(iv) Move all stores including long piles by barge from Nijmegen to Arnhem.

(v) Move all stores for Zutphen bridge by road from Arnhem to Zutphen on the main army maintenance route along the west bank of the Ijssel river.

The last two items enumerated above appear most uneconomical at first sight especially as regards the stores destined for Zutphen which would have to be double handled; an explanation is therefore essential to justify this breach of engineering economy.

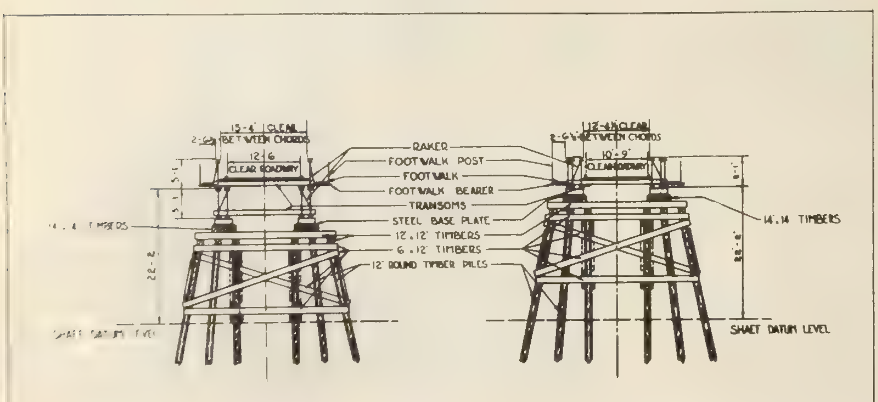


Fig. 3—Typical cross section of the Zutphen bridges

The advantages derived from the method were appreciated as follows:

(i) All stores traffic would be kept off the critical portion of the main army maintenance route between Nijmegen and Arnhem as well as off the temporary floating bridges at Arnhem and the one-way bridges at Nijmegen.

(ii) Barges could be loaded at Nijmegen, floated down to Arnhem (which was expected to be captured first) pending the capture of Zutphen and the highway between Arnhem and Zutphen.

(iii) The road haul over the main army maintenance route was cut down to the minimum as directed by army authorities.

(iv) Stocks in the bridge stores dump at Nijmegen could be kept down to a minimum as many train loads of stores would by-pass the dump

The two pile driving rigs at Zutphen viewed from up stream.

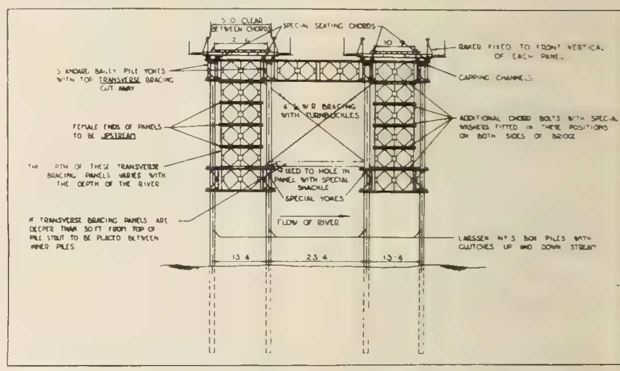


Fig. 4—Typical cross section of the Arnhem bridges.

and be shunted directly to the docks at Nijmegen to be loaded immediately in barges, thus cutting down double handling in the dump itself.

Materials available for bridge superstructure consisted almost entirely of standard Bailey bridge component parts. Very small quantities of rolled steel shapes could be made available if absolutely necessary.

For piers and foundations, many types of materials could be made available and the problem in this case rested on speed of construction more than anything else.

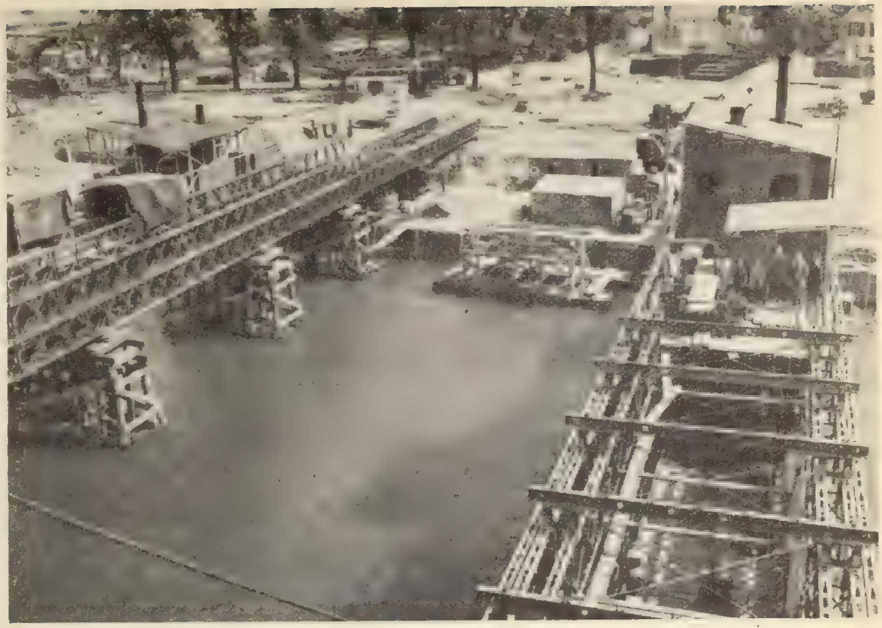
As study of geological records had shown that it was possible to drive piles of satisfactory bearing capacity at both sites, this type of foundation was adopted as a basis for preliminary planning. Timber piles 60 to

70 ft. long and of suitable cross-sectional area could be obtained from the Ardennes forest which was in Allied hands at the time. It was also estimated that some timbers suitable for piles would become available after the capture of the Hochwald and Reichswald forests.

Steel box piles had been manufactured in England to build jetties in the artificial harbours erected on the coast of France for invasion, and large stocks of these had not been employed and were made available for incorporation into the bridges.

General Design Features

On the basis of the above information, two types of bridges were designed. It is not within the scope of this paper to discuss the steps which eventually led to the adoption of these and only a brief outline of them will be given.



Top view of pile driving rigs taken from top of tower at Zutphen.

For Zutphen the general design provided for standard continuous Bailey bridges supported on timber pile piers; the class 70 bridge to be a triple girder through bridge and the class 40 a double girder decked bridge to permit the construction of a roadway of the specified width. (Fig. 3).

For Arnhem the general design provided for two decked Bailey bridges connected together laterally by standard Bailey panels and fitted with yokes prefabricated to receive steel box piles. Standard Bailey panels were also used as bracing frames between the steel piles; the load classification in this type of bridge is controlled by the width of roadway and the number and position of transoms (Fig. 4).

In designing these bridges, due consideration had to be given to the plant which would be required for their erection.

It was decided that, should the worst working conditions exist during construction of the bridges, the plant employed must allow the work to proceed uninterrupted. The choice of plant was therefore based on the assumption that the rivers would be in flood and that the current would be up to eight knots.

For Zutphen, pile driving rigs were designed with standard Bailey bridge component parts, suitable for pitching piles 60 ft. long clear of the water and which could be cantilevered to drive piers 60 ft. apart. Each rig consists of a Bailey cantilever and tower from which two pendulum type leaders are suspended. Leaders were fixed in position by a leader gate and a slipper, sliding on a guide joist fixed to connecting posts at the cantilever head. Each leader is served by one $3\frac{1}{2}$ ton single acting steam hammer, one $3\frac{1}{2}$ ton steam winch and one suitable boiler. The boilers and winches also act as counterweight for the cantilever. The maximum reaction on one pier supporting a pile driving rig in operation was calculated at 157 tons, due allowance being made for wind load, water load on piles being pitched and eccentricity of loading. This reaction being greater than that calculated for a fully loaded bridge was consequently used as the controlling load in designing the piers.

View of part of timber and pile yard at Zutphen. Note batter piles being driven by pile driving rig.

For Arnhem, where steel piles 70 ft. long had to be pitched through yokes level with the top chord of the bridge girders, it was planned to use a 10-ton mobile derrick on the bridge itself and to serve this derrick by means of a gantry travelling on the top chord of the guard rail suitably reinforced for the purpose; this gantry was designed to travel between the 10-ton derrick and the shore end of the bridge. It was also found necessary to provide trucks travelling on narrow gauge tracks set on the deck of the

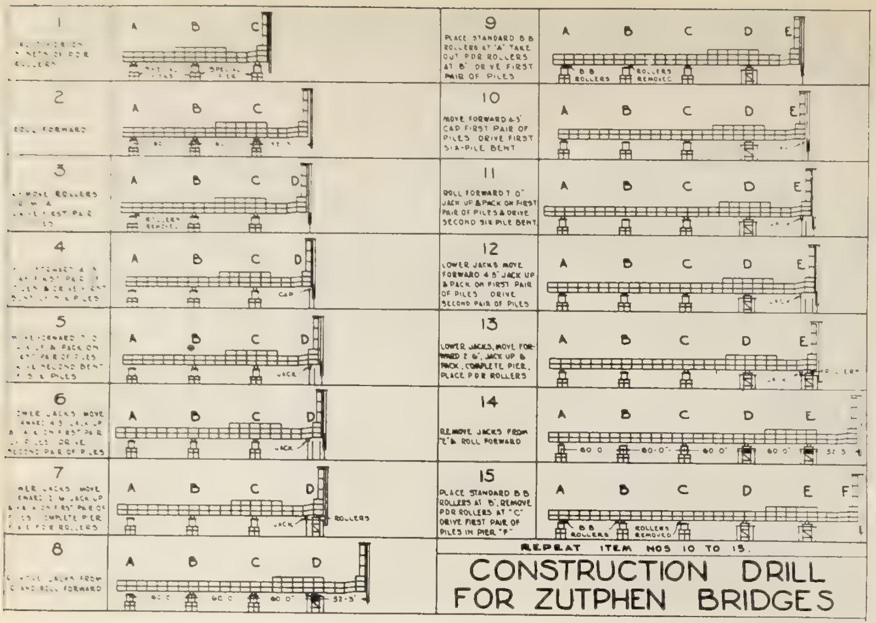


Fig. 5—Construction drill for Zutphen bridges.

bridge to feed the steel piles to the 10-ton derrick. The gantry and narrow gauge trucks were to be fed by a 7-ton stationary derrick so positioned along the shore end of the bridge as to be capable of picking up bridge assemblies and steel piles from the assembly yard.

The original plans provided for enough plant to work from each side of the rivers above flood levels in all cases. Provision was also made to take advantage of better working conditions, should these prevail; this consisted mostly of various types of crawler cranes fitted with swinging leaders and pile driving hammers which could be used to drive the approach piers across the flood plains when water levels so permitted.

Other items of plant for which provision was made included compressors, pumps, winches, generators, welding sets, motor tugs, blocks and tackle, forges, water tanks, concrete mixers, narrow gauge locomotives and trucks, tracks and turntables, flood lighting equipment, hydraulic jacks, bench saws and such tools and equipment which are part of the civilian bridge contractor's capital.

Production of Materials

Production of materials was put under way as soon as preliminary designs were approved. Provision of standard Bailey bridge component parts was an easy enough matter as it consisted simply of raising the volume of shipping of these items from England to the Continent to a quantity commensurate with the new demands. Pile driving hammers, winches, boilers, etc., were obtained from civilian firms in England and Belgium, and army workshops were put to work prefabricating special parts.

Forestry operations were put under way in the Ardennes forest under the direction of the Canadian Forestry Corps to produce timber piles 60 ft. long. Special road transporters which were designed and built by military workshops to move these piles deserve description. They consisted of:

(i) A tractor portion which is a heavy prime mover taken from a 40-ton tank transporter and fitted with a junction box on the turntable to receive one end of a steel pipe 6 in. dia. and 60 ft. long.

(ii) A towed portion which is a rear assembly taken from a 10-ton lorry suitably reinforced and fitted with a cylindrical joint into which the other end of the steel pipe can be placed, slid and secured to give the necessary length of "pole trailer".

(iii) Both portions are fitted with cross beams and hinged side supports to hold the piles in position in transit.

Although the production schedule went mostly according to plan, certain difficulties were encountered. The first one occurred when the Germans recaptured the Ardennes Forest during late December, 1944; this resulted not only in stopping operations but also in the loss of valuable mobile saw mills and other forestry equipment. So as not to delay production of timber piles, it was decided to cut "beech" piles from the Foret de Soignes south of Brussels; these had to be "squared" to 14 in. sides to reduce their weight but they still were more than twice as heavy as spruce piles and consequently, pile driving rigs and hammers had to be amended accordingly. However, the Ardennes Forest was recaptured and the forestry operations there were resumed in time to meet the production schedule. Some piles and other timber were cut from the Hochwald and Reichswald forests also, after these were captured.

A stores dump was opened in the railway yards at Nijmegen and arrangements were made for the loading of the barges at Nijmegen docks.

An outline of the quantities of materials handled through the dump is given in Table III to illustrate the stores problem.

TABLE III

Item	Description	Quantity
1	Timber piles 25 to 35 ft.	915 units
1 (a)	Timber piles 40 to 60 ft.	1,650 units
1 (b)	Timber piles 60 to 70 ft.	900 units
2	Steel box piles 50 ft.	200 units
2 (a)	Steel box piles 35 ft.	244 units
3	Square timber 12″ x 12″	10,000 lin. ft.
4	Bolts various sizes	10,000 units
5	Standard Bailey bridge	3,275 tons
6	Special Bailey parts	3,500 tons
7	Paint	1,000 gals.
8	Steam coal	750 tons
9	Cement	500 tons
10	Compressors	15 units
11	Concrete mixers	11 units
12	Mobile cranes 3 to 5 tons	22 units
13	Derricks 7 to 10 tons	4 units
14	Generators 4 kwh	18 units
15	Automatic pile hammers 3 to 5 tons	13 units
16	Locomotives (narrow gauge)	8 units
17	Special pile driving rigs	6 units
18	Pumps (petrol driven)	24 units
19	Power saws	9 units
20	Tractors	15 units
21	Welding sets	14 units
22	Winches (hand and steam)	25 units
23	Steam boilers	10 units

In addition to the above, considerable quantities of bolts, washers, pile shoes, pile rings and other general ironmongery were provided by military workshops and were delivered directly to the bridges as well as—

5,000 cu. yds. of rubble
3,500 cu. yds. of concrete aggregate
3,500 cu. yds. of sand fill.

A detail of all materials employed was kept at the dump, whether these passed through the dump or not.

In order to save time and labour at the bridge sites, all timber piles were ringed and shoed in the dump and much of the square timber was cut to size.

The movement of stores from base areas and forestry depots to Nijmegen dump commenced during the first week of April, 1945; the loading of barges for despatch to Arnhem commenced on 11 April, 1945. The dump was manned by 200 military personnel and 100 Dutch pioneers throughout its operational life.

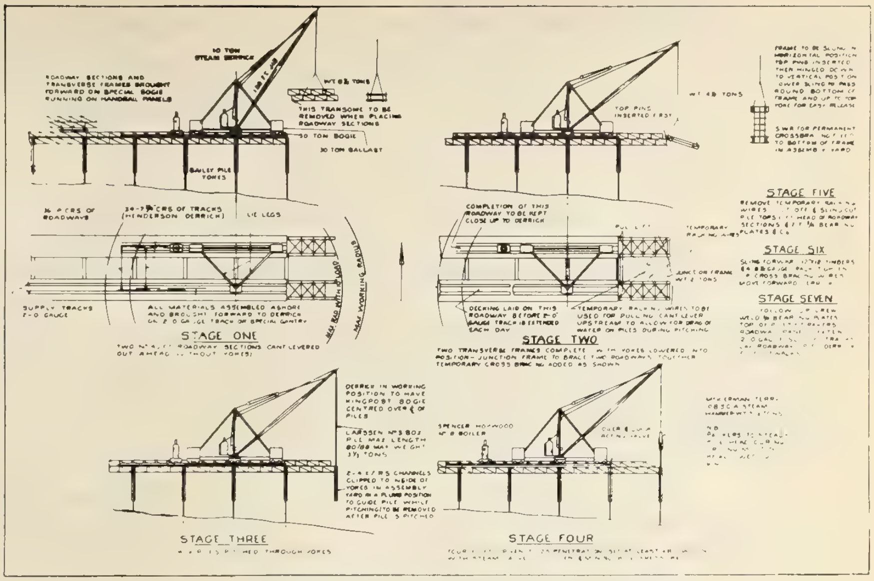


Fig. 6—Construction drill for Arnhem bridges.

Construction

The rate of progress on actual bridge construction will be better appreciated by a glance at the summary of events given in Table IV.

TABLE IV

Operation	Zutphen	Arnhem
Area cleared of enemy	15 April	15 April
Site survey started	16 April	16 April
Revised plans complete	20 April	20 April
First loads of stores delivered	23 April	24 April
Work commences	24 April	24 April
Bridges ready for traffic	26 May	28 May

It had been estimated that to work three shifts per day from each side of the rivers under flood conditions, 1,850 sappers, all ranks, would be required at each site to operate all the equipment and supply the necessary construction teams in addition to carrying out normal military duties and administration. However, the rivers were not in flood during construction and heavy plant was required on one side only, and the approaches over the flood banks were built from the ground. The maximum number of men employed on either project never exceeded 1,300.

Class 70 navigation span 100 ft. long at Zutphen. (Temporary pile bent is being dismantled.)

All work was carried out as a continuous operation, night and day, until the bridges were open to traffic. For night work, illumination was provided by flood lights at each individual main item of plant while general lighting of the sites was obtained by the reflected light obtained from clouds illuminated by anti-aircraft searchlights; this method of illumination is adequately called "artificial moonlight".

The bridges proper were built according to initial plans, the only amendments being in the lengths which had to be accurately determined after survey of the sites. The actual lengths of the bridges including approaches are:—

Zutphen, 1,450 ft. and 1,250 ft.
Arnhem, 2,250 ft. each.

The completed bridges at Zutphen were named Harry and Crerar respectively after the General Officer Commanding First Canadian Army, while those at Arnhem were named Simonds bridge and Foulkes bridge respectively after the General Officers Commanding 1st and 2nd Canadian Corps.

Conclusion

This paper attempts to point out the discrepancies which exist between planning normal peace time engineering projects as against war time army engineering operations. Whereas in peace time, cost is of utmost importance, in military engineering in wartime, cost is almost entirely ignored while time, transport and simplicity of construction become factors of great importance.

Acknowledgments

A complete list of personnel who deserve credit for the success of these military engineering operations is not warranted here, but this paper would be incomplete without mention of Lt-Col. G. W. Smith, O.B.E., R.C.E., Lt-Col. G. P. Stirrett, O.B.E., R.C.E., M.E.I.C., Lt-Col. G. L. MacDonald, M.B.E., R.C.E., Major Gaëtan Côté, M.B.E., R.C.E., Major M. Elson, M.B.E., R.C.E., and Major A. J. Leblanc, M.B.E., R.C.E., whose untiring efforts and devotion to duty greatly contributed to the success of the operations.

12,500 KILOWATT STEAM-ELECTRIC STATION

Of Nova Scotia Light and Power Company Limited

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and
J. W. MacDONALD, M.E.I.C.,
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Paper presented before the Montreal Branch of The Engineering Institute of Canada on February 1, 1945

The steam generating station which is the subject of this paper was projected as an addition to the electric generating facilities of Nova Scotia Light and Power Company, Limited, which serves the City and Fortress of Halifax and vicinity.

The Background

Until recently, the bulk of the energy required has been obtained from water power generated by a number of water power developments operated by The Avon River Power Company, Limited, a wholly owned subsidiary; and The Nova Scotia Power Commission; with only a small percentage generated by steam.

As the load grew, it became increasingly necessary to resort to steam generated power. This is illustrated by the load curve in Fig. 1. This diagram shows, in a heavy line, the total annual energy demand year by year. In a broken line is shown the total amount of energy available from the hydro-electric plants in a year of minimum runoff; the limitation being due to the amount of water which can be impounded and used rather than the capacity of the plants.

An examination of the relation of the two graphs in Fig. 1 reveals that, in 1939, the demands of the system absorbed practically all the hydro-electric energy that could with certainty be depended upon. This meant that increased energy demands would have to be met by steam generation, at least until an additional hydro-electric development then under construction, and another projected, should come into operation. Even with them, it was apparent that the need for steam generated power would be accentuated rather than reduced and would soon outrun the capacity of the existing steam plant.

Even though the aggregate amount of energy available in a given year may appear adequate, the supplier is not in a position to control the time and conditions of its use. It therefore becomes necessary to examine the situation from another aspect, that of the ability of the generating capacity to carry the peak loads encountered.

A study of the graphs in Fig. 2 indicates that, up to 1938, the hydro and steam generating capacity was ample to take care of the system peak demands, but in 1939 the latter overtook the former. This together with the expanding energy demands, pointed to the necessity of a substantial increase in generating capacity in order to safeguard the existing requirements and provide for growth, the extent of which was, as always, difficult to forecast.

Adequate water power sites within practicable transmission range, or susceptible of economic development, had in the main already been developed. The logical solution was additional steam generating plant. Steam has been the mainstay or the second string of electric production in Halifax for half a century. Moreover it gears in well with an important resource of the province, the coal mining industry.

Preliminary Considerations

The next question to be decided was the size of the proposed installation. The existing steam plant had a capacity of 5000 kw., installed when the consumption was only one-sixth of what it was in 1940. It was felt that a complete unit of 10,000 kw. was none too large for the present-day rate of growth.

A large steam unit in conjunction with a hydro system, dependent on water storage, has a distinct value in augmenting the output from hydro, inasmuch as it increases the range through which the water storage can safely be drawn down, without running the risk of being unable to replace the deficit before more water becomes available.

The first study made of the proposed steam plant embodied a building, housing two turbine units of 10,000 kw. capacity each, and boiler plant in proportion. It was considered, however, that one such machine would meet the immediate requirements; leaving the second to be installed later when needed, and when it was hoped that wartime restrictions on the supply of equipment and material would be relaxed. The same considerations ultimately led to cutting down the dimensions of the building to accommodate the single unit. Under normal conditions, it would have been preferable to complete the building in one operation.

A further modification arrived at in consultation with the turbine builders was that the turbine was redesigned to carry 12,500 kw. continuously instead of only for short peak periods. This modification provided a substantial increment of firm power at a nominal cost.

The broad decision outlined was arrived at on the basis of information available in 1940. It is interesting to examine how the actual load conditions in the ensuing period up to 1944 compare with the forecast made at the earlier date.

From Fig. 1, it is apparent that the total system load has increased, if anything, more rapidly than would be indicated by the steepness of the graph in 1939-40. Similarly from Fig. 2 an increase has taken place in the system peak demand which to-day is away beyond the combined installed capacity without the new turbine unit.

The first steps taken were to place orders for the main units, the boiler and the turbine-generator towards the end of 1941. After discussion of the various factors involved, such as long term fuel economy, availability of equipment and ease and economy of operation, it was decided to adopt a steam pressure of 600 lb. per sq. in. gauge, with a total temperature

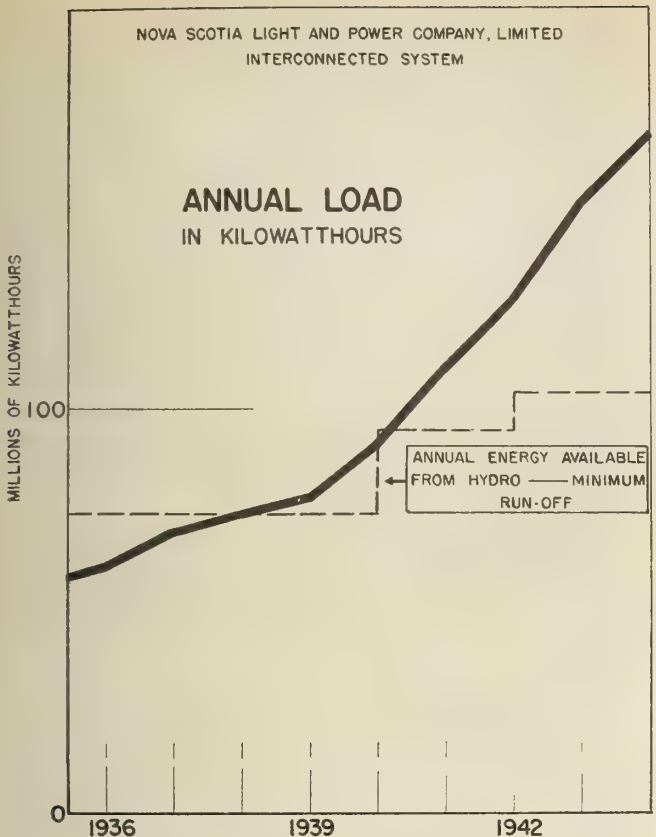


Fig. 1

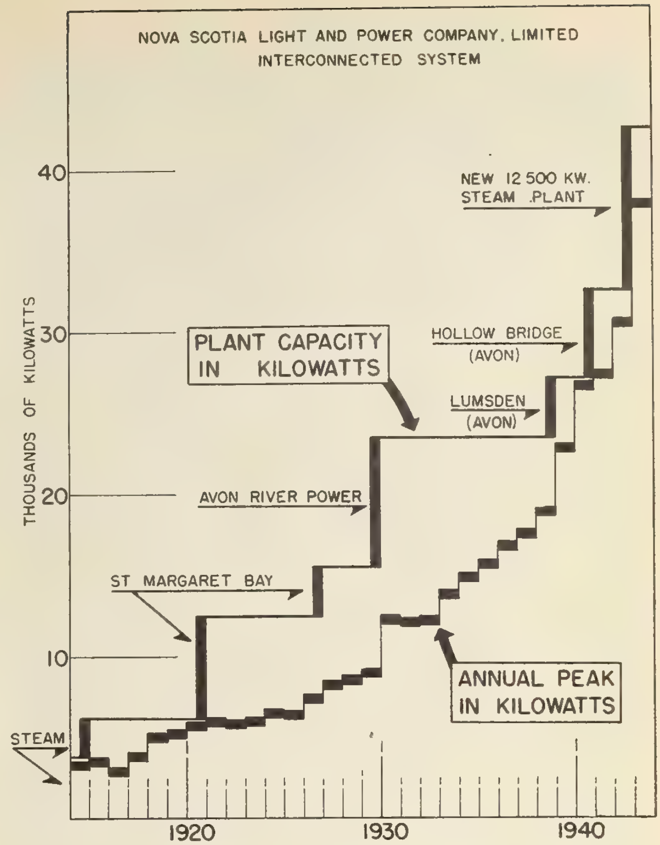


Fig. 2

of 800 deg. F. It was considered that this was as high as it was wise to go, in view of the practice up to this time in this country. Another point in favour of this limitation was that it made it possible to use in the boiler, drum plates rolled in Canada, which simplified the procedure of getting authorization to obtain this material, as well as making possible quicker delivery. The obvious fuel to be adopted in this area was Sydney coal. It is recognized that the best way of burning this coal, on a large scale, is in the pulverized form; so this method of firing was adopted.

In order to feed directly into the bus system of the existing station, the generator voltage was set at 4150 volts.

The company's existing steam plant which operates stoker fired boilers with steam conditions of 150 lb. pressure and 450 deg. total temperature, had undergone no basic revision in twenty-five years. The selection for the new plant of high steam temperature and pressure, a relatively large unit, and a different method of firing, presented problems in design and practice which were entirely new to the engineers and operating personnel of the company.

Montreal Engineering Company Limited of Montreal had already served in a consulting capacity during the building of the Hollow Bridge and Lumsden hydro plants, and also in the preliminary studies of this project. When it was decided that the new steam plant should be built, this company was retained to work out the manifold problems in design, selection and installation of equipment. The company also obtained the advice of Professor A. C. Christie, of Johns-Hopkins University, Baltimore, a leading authority on steam plant design in the United States.

Having obtained from the makers the general outlines of the equipment to be furnished, the next step was to decide on a site, and the design of building needed to house the equipment. The location of the existing steam plant was the most obvious selection as a site as being reasonably well placed for distribution of the city load, with the distribution facilities already provided.

Some consideration was given to the question of removing some of the older equipment in the existing building, and installing the new equipment in its place. It was realized, however, that the building in question was of the type designed for the machinery in vogue 30 or 40 years ago, and to adapt it for modern equipment would involve so much alteration, as practically to constitute rebuilding. Also, this would have seriously interfered with the functioning of the old plant during the period of reconstruction, and its full capacity was needed to maintain service. The power station property included some unoccupied space on the north side of the existing building, and it was decided to lay out the new plant in this area, keeping it entirely detached from the older building, but lined up so that future extensions could be carried out by replacing the old building piece by piece with construction on the lines of the new addition.

While space was available, as mentioned, for a building site, it consisted of made ground on the west or landward side extending to an old cribwork or seawall beyond which the ground was submerged several feet beneath the water of the harbour. This bulkhead ran approximately about the middle of the proposed new building. Hardpan was found about 20 ft. below mean water level at the landward side of the building sloping to about 35 ft. on the east or harbour side. The harbour front at this point runs approximately north and south.

Cribwork

In preparing the site, the first step was to build a cribwork of 12 by 12 in. creosoted timbers extending along the harbour front from the old power house to the north boundary of the property, a distance of 121 ft., and then 90 ft. in shore along the north boundary. In building this cribwork, provision was made for an inlet chamber with screens, and a pump chamber in which the cooling water pump could be placed. This cribwork was 18 ft. wide and about 26 ft. high.

The natural underwater floor at the crib site was too soft to provide a good foundation so a trench about 40 ft. wide was dredged down to hard bottom and then backfilled with rock and levelled off. The crib sections — three in number — were floated into their positions over this base and sunk with rock ballast. Except for a bulge of about eight inches near the middle of the harbour front, the crib was finally placed almost exactly in the position intended.

The area inside the cribwork was heavily piled with 12 in. creosoted pine piles estimated to have a bearing capacity of 15 tons per pile. The piles were arranged in clusters to support the figured loads on the various building columns, some of the clusters consisting of 15 piles. In addition, piles were driven to support the boiler and turbine and some of the heavier individual pieces of equipment. In all 286 piles were required. The column piles were cut off and capped with concrete blocks 36 inches in depth heavily reinforced. Concrete mats of the same depth were poured to form the sub-bases of the turbine and boiler.

Concrete beams were formed over the column foundation caps, joining these caps. These served to stiffen the whole structure horizontally and also to support the weight of the building walls and the floor slab. This latter was laid over the beams and formed the ground floor of the building. The finished level of this floor was 7.15 ft. above the mean tide level. The concrete quantities were:

Pile caps	220 cu. yds.
Main floor	215 " "
Machine mats	132 " "

There was thus a total of 567 cu. yds. of concrete below the main floor level.

In addition to the foregoing, ten piles were driven on the north side outside the building area to support the ash tank. Also four piles were driven 40 ft. to the south of the south wall to form a base for a tower carrying the coal conveyor.

In the course of the underground work, a 6 in. pipe was laid under the central bay from north to south for connection to the city water supply and with two 6 in. outlets in the power house. This was subsequently connected through a meter in a meter pit in the yard to the city main on Water Street. At the south end it was continued to join up with the fresh water supply in the old power house, thus forming a complete loop and ensuring a continuous supply in the event of a portion of the city main being temporarily shut off.

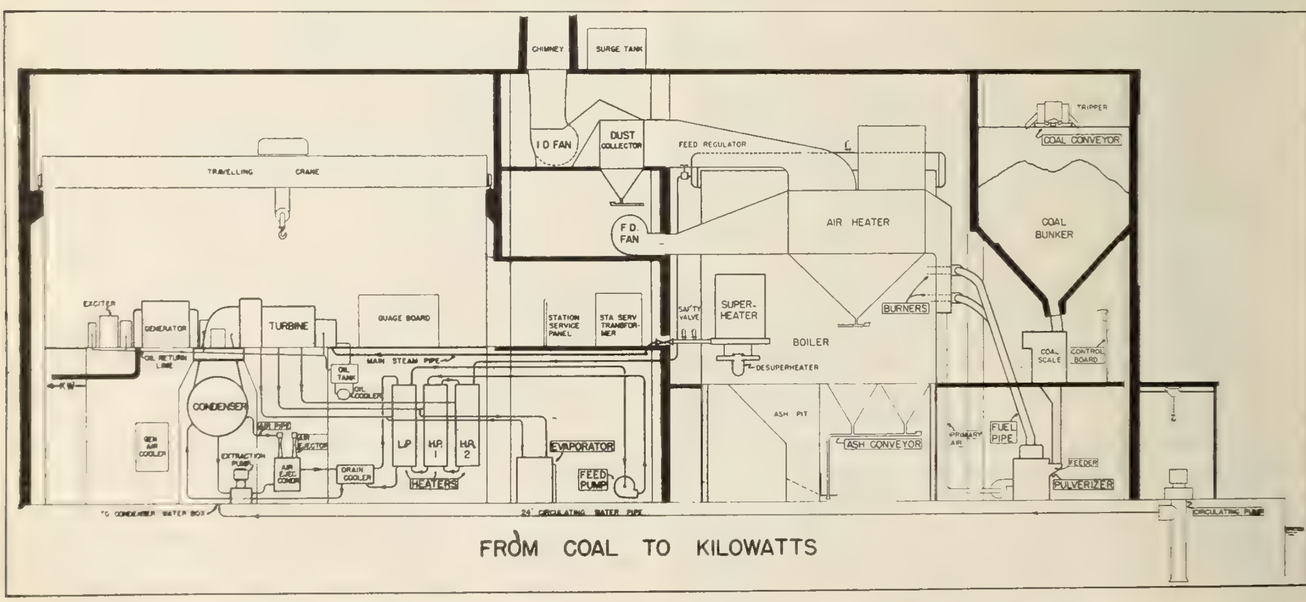
The 24 in. cast iron pipe for the incoming and outgoing cooling water was also laid below the floor.

Drain pipes were also laid with connections for down spouts from the roof, and from various points at which drips and drains would have to be provided for.

Design Features of Building

The superstructure of the building had to be planned in considerable detail in order to determine the foundations that would be required. The company secured the assistance of Mr. Clifford St. J. Wilson, M.E.I.C., M.R.A.I.C., and his associate the late Mr. A. R. Cobb, F.R.I.B.A., both of Halifax. Their experience with waterside construction in Halifax proved of great value. Mr. Wilson elaborated the details of the building proper following the general plans formulated to meet mechanical requirements.

Owing to the difficulties and delays in obtaining structural steel at this time, it was decided to design a building entirely of reinforced concrete. This was carried out throughout, except that, before that stage of construction was reached, it became possible through the easing of the steel situation to substitute steel trusses for the very heavy concrete beams designed in the first instance for the long roof spans over the turbine room and boiler room.



Longitudinal section through the building.

The building columns were 24 in. square set on centres 20 ft. apart. There were three such columns in the east and west walls, making the building dimension in this direction 40 ft. Any future extension of the building would be in this direction—that is, heading south. In the north and south walls there were eight columns, making the building dimension from east to west 140 ft.

For convenience in referencing, the rows of columns running east-west were designated by letters, A, B and C, commencing at the north end, while the individual columns in these rows were number 1 to 8, commencing at the east side. In the boiler room, to avoid interference with the firing front, the column in row 'B' was omitted, and was replaced by intermediate columns on 10 ft. centres from the north and south rows, and designated AB-2, and BC-2.

The easterly 60 ft. of the building was allotted to the boiler room, the coal bunker occupying 20 ft. at the eastern end, with the operating floor underneath. This left 40 ft. for the boiler proper which allowed for a rear alleyway of about 5 ft.

The middle 20 ft. between column rows 4 and 5 was set aside for a series of floors to accommodate auxiliary machinery such as pumps and fans. Intermediate columns were provided on the same 20 ft. spacing to carry these floors.

The westerly 60 ft. formed the turbine room. The columns, rows 5 and 8, on the east and west side of this room were increased to 36 in. width to a height of 40 ft. to support beams to carry the rails of an overhead travelling crane.

The panels of the outside walls were formed in reinforced concrete between columns.

No window openings were left in the wall panels as, at the time the building was designed and executed, it was felt that the possibility of bombs exploding in the vicinity was still a real hazard to be guarded against.

Reinforced concrete slab floors were provided in the central bay at elevation 20, 31.5 and 43 ft. above the ground floor. At the north end of each of these floors a 12 by 5 ft. hatchway was provided. This was to permit of heavy parts, such as fan wheels and shafts, being lowered to the ground floor; and landed alongside a large doorway in the north wall, where if desired they could be loaded directly on, or lifted from, a truck. Eye-bolts were imbedded in the roof above the hatchways in convenient location for supporting lifting tackle.

A floor was built in the boiler room at elevation 15.0 above ground floor. This floor was laid out to surround the boiler in the front and rear and on both sides; though portions of the floor were omitted to permit of handling boiler parts during erection, to be filled in later. This floor was entirely independent of the boiler structure, so as not to hamper any movement of the boiler casing due to expansion. On the east or front side of the boiler large openings were left in the floor and fitted with open grating to provide ventilation in this space, which constitutes the boiler operating floor.

At roof level—55.5 ft. above ground floor—heavy concrete beams connected the outside columns and also those forming the central bay. Upon these was supported a 5 in. thick reinforced concrete roof.

The roof over the boiler room and also over the turbine room was carried on steel trusses running in an east-west direction, with steel purlins at 10 ft. centres. These trusses extended between the intermediate columns of row 'B' and also between the columns of row 'C' in the south wall, so that in the event of the extension of the building southward and the removal of the south wall, the roof would not be left without support at that point.

At the north end of the central bay, a beam structure was designed to carry the chimney. At the south end provision was made for a surge tank. To enclose the latter a penthouse 20 ft. square was carried up another ten feet above the roof.

The total yardage of concrete in the building superstructure was 1166.

Incorporated in the building structure was a reinforced concrete coal bunker. The upper portion of this bunker is rectangular; 20 ft. wide and 40 ft. long running along the east side of the building.

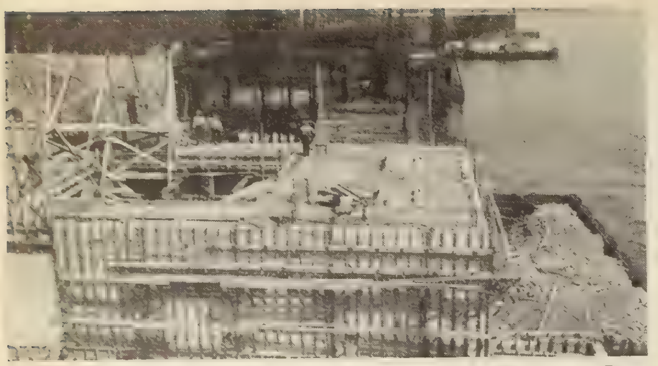
The east and north and south building walls, form the walls of this rectangular section, while the west wall of the bunker extends along the row of north-south columns designated number 2, 20 ft. from the east building wall. The lower portion of the bunker consists of two hoppers in the shape of inverted pyramids. The sides of these hoppers are inclined 40 deg. from the vertical, and converge symmetrically to their discharge outlets which are thus spaced 10 ft. from the east wall and 20 ft. apart. The actual outlet of the hopper was arranged inclined about 7 deg. to the vertical, this being found necessary to suit the disposition of the coal handling equipment beneath. The additional concrete involved in the bunker was 83 cu. yd.

The construction of the coal bunker in concrete was dictated by the prevailing scarcity of steel. It has the advantage of not being subject to corrosion, but on the other hand the thickness of walls and stiffening beams reduce the volumetric capacity. Transverse beams were arranged at the bottom of the rectangular section, and also at the top of the bunker 48 ft. above ground floor. These latter at 10 ft. centres formed supports for the coal handling equipment.

The contract for the foundations and building was undertaken by Messrs. T. C. Gorman (Nova Scotia) Limited. Actual construction on the cribwork was commenced in August 1942. Scarcity of labour at that time greatly hampered progress, but by the end of that year the cribwork and piling had been completed, and caps and connecting floor beams poured over the heads of the groups of piles. At this stage it was decided to defer proceeding with the superstructure until the spring of 1943, as by that time it had become evident that inevitable delays would postpone the delivery of the major equipment until well on in 1943. The building of formwork and pouring of columns, beams, wall panels and floors was consequently proceeded with in April 1943, and with the labour conditions prevailing, the building was closed in about the middle of November of that year. The building was then ready for the installation of the machinery as soon as it should be delivered.

Turbine Unit

The main generating unit is a turbine-generator of 10,000 kw. maximum continuous rating at 80 per cent power factor, or 12,500 kva. at unity power factor. The turbine is designed to carry a load of 12,500 kw. The complete unit was supplied by Messrs. C. A. Parsons and Company, Limited, of Newcastle, England. It was built during a period of stress when the



Construction has progressed to the boiler operating floor.

builders were crowded with work of the most urgent nature; when working forces were thinned by the demands of the fighting forces; and in a locality peculiarly and constantly subject to the threat of enemy action in the shape of aerial bombing; and finally made the Atlantic crossing in the face of submarine dangers to arrive at Halifax with no significant piece or detail missing or damaged; truly a notable example of British thoroughness and dogged endurance.

The turbine foundation block was built from detailed plans furnished by the makers, supplemented by a model in wood to a scale of one-half inch to the foot. This block was based on the concrete mat supported on piles earlier referred to, to which it was securely tied by projecting dowels left in the mat.

The turbine block itself consists of two main masses of concrete; one under the steam end of the turbine and the other under the generator. These are tied together with two heavy beams imbedded in the concrete, which beams afford a support for the exhaust end of the turbine casing. The open space beneath the beams is occupied by the condenser. Suitable cavities are arranged in the turbine end block for bringing out the various connecting pipes; and the generator block is formed with a cavity to accommodate the generator air cooler and the passages necessary for air circulation.

The completed turbine block contained 170 cu. yd. of concrete and 10,000 lb. of steel for reinforcement.

The operating platform consists of Irving "Subway" flooring on steel framework supported on brackets attached to the sides of the foundation block. The surface of this platform is 20 ft. above the ground floor of the building, on the same level as the second floor of the intermediate bay of the building, to which it is connected by a walkway.

The chief operator's office is situated on this floor opposite the steam end of the turbine unit. It is arranged with large glassed-in openings so that the unit and instrument boards and other accessories are in full view.

The turbine itself is of the Parsons full reaction type. In this type of turbine, the shaft is short compared with its diameter, this contributing to steadiness and absence of vibration. The length of blades is such that clearance losses are minimized. In order to reduce to a minimum steam leakage through the axial clearances of the blading, the axial position of the rotor in the casing is adjustable.

The spindle is a forging of high grade steel, carefully heat treated during the processes of forging and rough machining. It is bored centrally throughout its length, so that its physical state can be examined. It is finished at the journals, grooved, and serrated to receive the blading and machined at the end with a worm for the governor drive and a thrust collar, and at the exhaust end to form a half coupling. The blading is of stainless steel fitted and locked in the grooves in the spindle. There are 57 rows of blades. The high pressure blades are "end-tightened" with shrouding strips; while the longer low pressure blades are reinforced with intermediate binding strips brazed to the blades which are tapered down towards their outer tips. The completed rotor is accurately balanced statically and dynamically.

The turbine casing is split horizontally with all but two steam and other connections in the bottom half, so that the top covers can be removed with minimum uncoupling of these connections. The high pressure portion of the casing is of cast steel, while the low pressure portion including the exhaust outlet is of cast iron. The upper and lower halves are bolted together with substantial flanges, the joint being metal to metal. These flanges are accurately dowelled and are held together with studs and bolts, bored so that they can be heated with an electric element when making the joint. The casing is supported on pedestals at the exhaust end, rigidly bolted to the foundation, while the steam end is supported on a foot resting on, and guided by, a machined sole plate to allow for expansion of the casing.

The casing is machined with grooves to receive the stationary blading. The top covers are provided with lifting eyes; and long guide studs are set in the lower half of the casing to locate the cover until the blading has been safely separated, thus guarding against injury to the blading while assembling or dismantling.

The steam and exhaust ends of the casing are machined to receive the housings of the seal glands which are of the carbon segment type. These glands are controllably supplied with steam, to prevent the escape of steam at the steam end and the inflow of air at the exhaust end of the casing.

The steam chest is of cast steel, with feet bolted to a definite position in the foundation block on the north side of the centre line of the turbine. It is detached from the turbine cylinder, being only connected thereto by flexible steam pipes. This arrangement prevents any stresses being carried from the main steam header to the turbine casing.

The throttle valve is mounted on the steam chest, and is fitted with a steam strainer on the inlet. It is opened against spring pressure and held open by oil pressure which, when released, causes the valve to close instantly under the action of the spring. This pressure release is affected when the overspeed governor, consisting of a bolt held eccentrically by a carefully graded spring arranged diametrically near the end of this turbine spindle, is thrown out by centrifugal force sufficiently to contact a pivoted finger. This finger trips the pilot valve controlling the oil supply to the throttle valve. The overspeed governor is designed to trip at 10 per cent over normal speed, and repeated tests have demonstrated that its action can be depended upon within a close margin.

The trip finger is formed with a protruding lip by which in the event of an emergency it can be displaced with a touch of the human finger, thus checking the flow of steam to the turbine. It is protected by a shield to avoid the possibility of the trip being thrown unintentionally.

The regulating valves are also mounted on the steam chest body. They are operated by relay cylinders. The control of the oil to the cylinders is effected by a valve actuated by the turbine centrifugal governor which is driven through a worm and gear from the turbine spindle. The pilot valve is capable of hand adjustment to vary the speed 5 per cent above or below normal.

Oil pressure for operation of these valves and for the lubrication system of the turbine is normally obtained from a gear pump direct driven by means of an extension of the governor shaft. An auxiliary oil pump is provided driven by a steam turbine supplied with steam through an automatic valve, which admits steam and starts this pump when the oil pressure in the system falls below a pre-determined minimum pressure of 35 lb. per sq. in.; as when, due to reduced speed during starting up or slowing down, the direct driven pump does not set up the necessary pressure.

A tachometer is mounted on the cover of the thrust bearing and the governor. This is driven from the extension of the governor shaft and has an open scale reading well above and below the normal speed of the machine.

The oil tank is set at the steam end of the turbine just below the operating platform level. It has a capacity of 450 Imp. gallons. Mild steel oil pipes connect the tank to the oil pump suction and to the oil cooler arranged below the tank on brackets on the turbine block. Connections are also provided to a Hopkinson Centrifuge permanently set on the floor below the tank. This provides for continuous purification of the oil.

The oil cooler is of conventional design, with a tube element consisting of tubes expanded in a tube plate and a water box connected by piping to the incoming and outgoing condenser cooling water. The oil circulates in the body of the cooler outside the tubes and baffles are provided to ensure satisfactory circulation of oil over the tubes.

A gauge board is set up on the operating platform in close proximity to the main throttle valve. This board contains pressure gauges showing the pressure of steam at the throttle valve, at the turbine normal and overload inlets and at three extraction points. There is also a Kenotometer showing the absolute vacuum existing in the condenser in inches of mercury column. It also contains a complete set of pressure gauges indicating the conditions existing in the oil system, including the pressure set up by the direct driven pump or the auxiliary pump, at the inlet to the oil cooler, the relay pilot oil and the bearing oil. Also there is a vacuum and temperature alarm to give warning if the vacuum at the exhaust becomes abnormal; and a stator temperature indicator by which the temperature can be determined at any one of six points in the generator stator windings.

Adjacent to the gauge board is an entablature on which are disposed the handwheels of the various valves involved in the operation of the unit. Each individual valve is labelled to indicate its function; and is fitted with an " Open and Shut " indicator.

Condenser

The condenser is of steel plate welded construction. It is suspended from the exhaust flange of the turbine casing, and provided with heavy springs to relieve the weight on the turbine cylinder. It is set transversely to the length of the unit with the inlet and outlet cooling water connections at the south end.

The condenser is the two pass type. The tubes are of aluminum bronze ¾ in. outside diameter and 12 ft. long. The total cooling surface is 7000 sq. ft. The tubes are rolled into the tube sheet at the end where the water leaves and are ferruled at the outlet end.

The cooling medium is sea water drawn from the harbour. It is pumped by a Drysdale vertical axial flow pump with a rated capacity of 8,000 Imperial gallons per minute against a total head of 25 ft.

The characteristics of axial flow pumps are the reverse of those of the centrifugal type, inasmuch as the power input is a maximum against a closed outlet and a minimum at lowest head with maximum output. In this case the discharge from the condenser is submerged so as to take advantage of the syphon effect, and consequently the total head pumped against is that due to friction losses in the condenser and piping, regardless of the state of the tide. As the pump serves the single condenser, there is no need for shut off valves in the circuit, and the pipe leading to the condenser is arranged to drain back through the pump. Thus the pump always starts with a free discharge and the head builds up as the discharge flow increases. A steam ejector is provided to clear the condenser and pipes of air when starting up.

The pump consists of a vertical cylindrical casing having a renewable bronze liner, guide vanes, impeller and spindle, this spindle being fitted with renewable bronze sleeves and supported by means of a white metal lined journal bearing bracket. The weight of the rotating parts and any unbalanced thrust are carried by a Michell thrust bearing situated in the motor stool on the upper end of the casing.

The pump is submerged in a well formed in the cribwork on the east side of the boiler room with the entrance throat some 18 inches below extreme low water level, and 6 ft. clear of the bottom of the well. The necessity of priming is thus obviated. The well itself is 6 ft. square and the entrance for the water is 5 ft. wide by 6 ft. deep. This intake timbering is provided with grooves in which are fitted a pair of screens of copper mesh, so arranged that the screens can be hoisted up for cleaning, while the pump is in operation.

The motor stool, from which the pump casing is suspended, is supported on a substantial reinforced concrete bracket built out from the building foundations, so that it is independent of any movement of the cribwork.

This stool carries the rotating parts of the pump through the Michell thrust bearing and also the 80 hp. motor, the shaft of which is coupled to the pump shaft by means of a flexible pintype coupling.

The assembled pump and motor is housed in a lean-to building outside the east wall of the boiler room. The roof of this outhouse is 15 ft. above the boiler room floor, high enough to allow of the pump being lifted out of the well for inspection or overhauling. For this purpose an overhead trolley hoist is provided, running on a beam underneath the roof of the pumphouse.

The cooling water is discharged through a horizontal branch near the top of the pump casing and is conveyed to the condenser inlet through a 24-in. cast iron pipe laid in a trench running along the south side of the boiler room. A similar pipe from the condenser outlet discharges the water into a slip on the north side of the property, the outlet being arranged well below low water mark as mentioned before.

Branches from the cooling water main serve the oil cooler and the generator air cooler, the discharge being led back into the condenser outlet pipe.

The condenser has a 16 in. atmospheric exhaust at its north end with an atmospheric exhaust valve of conventional design exhausting into a 16 in. vertical stack carried through the roof close to the north wall and clear of the overhead crane at the limit of its travel. On the exhaust side of the valve is a manifold arranged to receive and dispose of exhaust vapour from various points.

The condensate is removed from the condenser by a motor-driven vertical extraction pump situated on the floor on the north side of the turbine block. This condensate pump is of ample capacity to deal with the quantity of condensate when the exhaust from the turbine is a maximum, against an external head of 77 ft.

The condensate leaving the condenser passes first through the air ejector condensers, and thence to a low pressure heater on its way to the boiler feed pump suctions.

The air ejector is arranged on the operating platform on the north side of the turbine with a short air suction pipe from the condenser. It is a two stage steam jet ejector fed by a branch from the main steam pipe. The steam used is only 360 lb. per hour and the bulk of this is condensed, heating the feed water about 4 deg. at full load. The resulting condensate is drained back to the condenser. The air and any uncondensed vapour is vented to the atmospheric exhaust pipe.

Crane

The turbine unit is served by a 20 (long) ton Morris travelling crane running on rails on the east and west walls of the turbine room. The lifting motion is motor driven, controlled by a trailing extension cord and switchboard. The travelling and traversing motions are operated by pendant chains.

Feed Heating

The feed heating cycle consists of three stages of heaters supplied with steam extracted from the turbine at three bleed points.

The feed water, after leaving the air ejector condensers, passes to a low pressure heater. This low pressure heater has, as an adjunct, a drain cooler, a heat exchanger which cools the warm condensate from the low pressure heater and imparts heat to the feed water before it enters the low pressure heater. In the low pressure heater the feed water is raised to about 180 deg. by means of steam drawn from the low pressure bleed point, which at normal turbine load is slightly below atmospheric pressure with a temperature of about 190 deg.

At this temperature the feed water passes on to the suction header of the feed pumps at a pressure sufficiently high to avoid flashing at the pump suction.

After leaving the feed pump at a pressure of 850 lb. per square inch and upwards, depending on the pump output, the feed water passes in series through two high pressure heaters designed for a working pressure of 900 lb. per sq. in. and tested to double that pressure. These heaters, like the low pressure heater are of the U tube type, set vertically with the water connections in the top cover and the steam and drain connections in the body.

The steam for No. 1 high pressure heater is drawn from the intermediate bleed point at which the pressure, at normal load is about 45 lb. per sq. in. absolute and the temperature about 300 deg. F. showing a small amount of superheat.

From this heater the feed water passes to the No. 2 high pressure heater which draws steam from the high pressure bleed point at a pressure, at normal load, of 135 lb. per sq. in. absolute and a temperature of about 500 deg. F. or about 150 deg. of superheat. This raises the temperature of feed water to about 340 deg. F., at which temperature it is delivered to the boiler.

It will be understood that all the bleed steam pressures and temperatures increase up to the maximum continuous rating of the turbine; and the resulting feed water temperatures show corresponding increases.

The condensate produced in each of these heaters is drained to the next lower stage heater; and finally through the drain cooler back to the condenser.

The extraction or condensate pump is designed with some excess capacity and some condensate is normally returned to the condenser through a recirculation pipe, so as to always maintain a sufficient head of water over the extraction pump suction. In addition the pump discharge has a branch leading to what is known as the auto feed valve. This is a float type of valve connected by balancing pipes to the water space in the condenser.

It is so arranged that if the condensate and feed system is not taking away the condensate as fast as vapour is being condensed, and water accumulates above a certain level in the condenser, the auto feed valve opens to allow the surplus to go to the surge tank. Under the reverse condition, the auto feed valve acts to allow water to be withdrawn from the surge tank, but not directly to the condensate line but instead to the condenser. In the open surge tank the water is liable to pick up oxygen, and therefore provision is made that any water drawn from this source is subjected to the de-aerating action of the condenser before being returned to the feed water system.

Evaporator

In order to avoid making up any losses of feed water by introducing raw water, a double effect evaporator system is installed in the central bay near the feed water heaters. The first stage is supplied with steam drawn from the intermediate bleed point of the turbine, and the condensate from both stages goes to the condenser by way of the drain cooler. The water evaporated from the first stage is condensed in the second stage evaporator, while the evaporation from the second stage goes to the L.P. Heater, which thus performs the function of a condenser of the distillate. The supply of raw water to the evaporator system is controlled by a float valve. A motor driven sludge pump discharges to the drain, carrying away the bulk of the solid materials left behind in the process of evaporation.

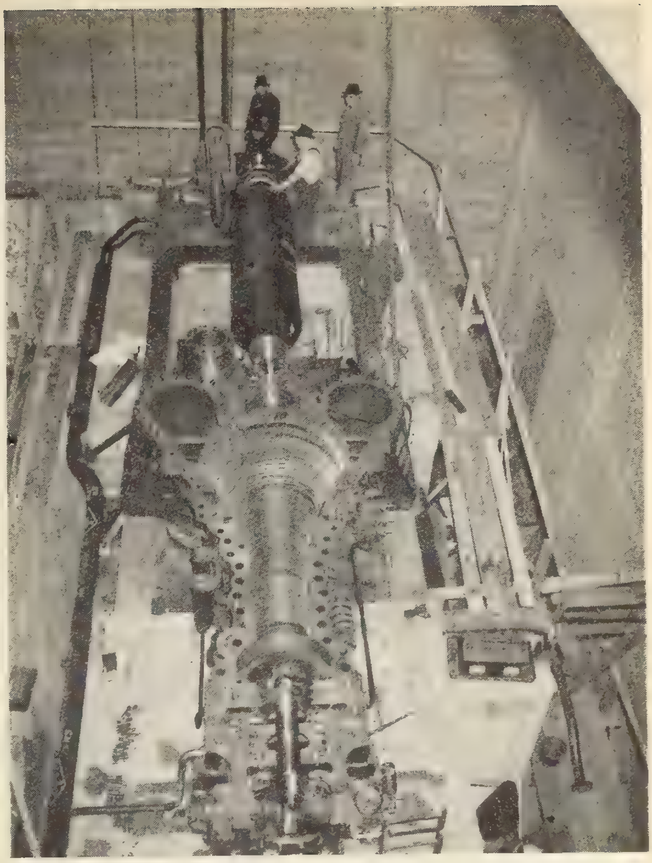
The evaporator system is designed to provide 5 per cent make-up based on the maximum steam demand of the turbine or about 6,000 lb. per hour. As a matter of fact a small percentage of this is found sufficient to make good all losses, and it is only necessary to operate the evaporator intermittently.

Generator

The Parsons generator, which is of the conventional revolving field type, is designed for a continuous maximum rating of 12,500 kw. at 4,160 volts unity power factor, the efficiency being 96.3 per cent. The armature reactance is 12.5 per cent. The inherent regulation at unity power factor is 35 per cent; and at 0.8 power factor 50 per cent.

The stator is the heaviest piece of the entire unit weighing approximately 22 tons. It is fitted with six thermo-couple temperature detectors, connected to a Cambridge indicator arranged on the turbine room instrument panel. The rotor body and shaft are made from a single forging machined all over, with a claw type flexible coupling fitted on the turbine end. Bearings are of the self-aligning type made in halves and lined with babbitt; the main rotor bearing nearest the exciter provided with thrust strips to limit the axial movement of the rotor. The machine has its own exciter coupled direct to an extension of the rotor shaft. Voltage control is obtained entirely by adjustment of resistance in the exciter field circuit, a Brown Boveri automatic regulator being used for this purpose. The exciter is rated at 48 kw., 220 volts.

Fans for circulation of cooling air for the generator are fitted to the rotor. The ventilation system is completely sealed off with an air cooler of the surface type fitted in a rectangular frame work in the generator foundation block. Sea water tapped from the main condenser water line constitutes the cooling medium, the quantity diverted for air cooling being 300 Imperial gallons per minute. This air cooler is mounted on wheels so that in the event of trouble such as a leaking tube, it can be run out on the main floor and repaired. The main generator leads are brought out under the stator through a suitable void left in the concrete base.



Checking alignment after installing rotor and spindle.

Conductor and Switchgear

A large proportion of the primary feeders supplying current to the City of Halifax radiate from the Water Street substation which is situated adjacent to, and on the west side of the old power station. The new unit is designed to generate at 4,160 volts so that it can feed directly onto this substation bus. Switchboard operators are on continuous duty in the substations and it was considered advisable to place electrical operations affecting the new generator, as much as possible, under their control.

To carry out this plan, it was necessary to provide a group of conductors connecting generator and substation. The required number and sizes of conduits was figured and a few spares added for future use. A trench was dug across the yard between buildings, and floor and wall forms built in this trench, all well below finished grade. Then the conduits, held in proper relative position by concrete spacers, were laid in this form and fastened in place. Reinforcing bars were added where considered necessary and finally the whole form was filled with concrete. After allowing a few days to cure, a coat of waterproofing was applied to the concrete and the excavation backfilled to yard level.

Four-inch fibre conduits are provided for the three main generator leads each of which is made up of a paralleled pair of 1,250,000 C.M. lead covered cables. Smaller fibre and steel conduits carry station service feeder, intercommunication circuits and all control wiring necessary to provide the substation operator with complete control of load on the unit.

For guidance of the turbine operator, a field panel is installed beside the turbine gauge board on which are indicating meters for kilowatt load, load current, field current, and field voltage. Current overload and differential protection is provided for the generator, and the requisite relays are also mounted on this field panel.

The generator panel installed in the substation provides for the switchboard operator, the following meters: kilowatt load, generator volts, load current, field volts, frequency, power factor and recording kilowatt hours. Mounted on this panel also are control switches for generator and field breakers; an automatic voltage regulator with change-over switch for manual control and a turbine governor control switch.

In the routine operation of putting the machine on the line, the turbine operator brings the unit up to speed, fully opens the throttle valve, and, after testing the hydraulic operating governor, signals to the switchboard that he is ready. The latter then builds up voltage, and with the remote electrical speed control brings the machine into synchronism and closes the main breaker. A pilot light on the field panel tells the turbine operator when this switch is closed. Adjustment of load is entirely at the disposal of the switchboard operator. Communication between the two panels is by a loud speaker system or; as an alternative, by direct telephone.

Station Service

Energy for station service is taken from the 4,000 volt substation bus, through a three conductor cable to a 1,000 kva. transformer situated on the operating floor of the new plant. The secondary of this transformer is connected to a station service panel, which distributes power at 550 volts to all auxiliary motors.

A small 550/220 volt single phase transformer is provided to take care of station lighting. An emergency direct current lighting system, installed in the plant, is so arranged that on failure of the regular lighting, it cuts in automatically and gives the operators about the minimum amount of light required to carry on in safety.

Boiler Unit

The boiler plant consists of the boiler proper with completely water cooled furnace, a pair of pulverizers and burners, a superheater in two stages with intermediate desuperheater and an air heater; with the necessary steel frame and housing. It is designed to produce 110,000 lb. of steam continuously; or 125,000 lb. for a two-hour period.

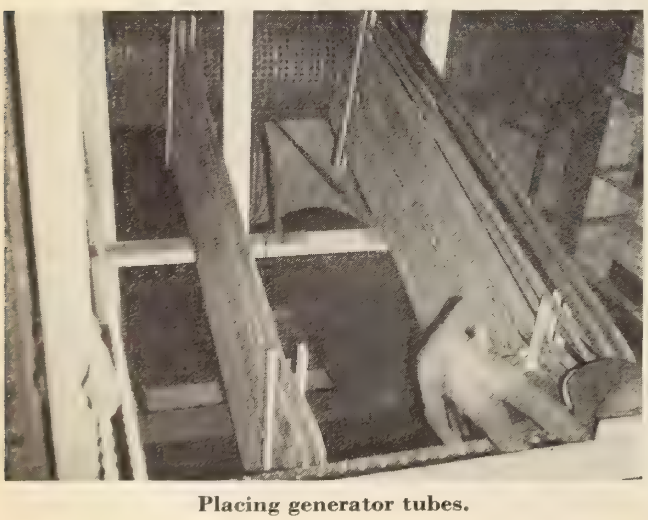
The boiler proper is the Babcock Integral furnace type. The steam drum is 54 in. dia. of welded construction, 32 ft. long. The plates used are 3 and 1¾ in. thick, the heavier plate being used where perforated to receive the tubes. The lower drum is 42 in. dia. the plates being 2-5/16 and 1-13/32 in. thick respectively. The steam drum is fitted internally with cyclone separators to ensure that moisture free steam is delivered to the superheater.

Tubing of 3¼ in. dia. is arranged to surround the furnace on all four sides as well as top and bottom, the bottom tubes being overlaid with Bailey blocks. The furnace bottom has a hopper to the rear, the sloping side of which is also protected by water tubes and blocks, the total boiler heating surface is 14,826 sq. ft.

The lower drum rests on saddles with its centre 2 ft.-3 in. above the operating floor. The centre of the steam drum is 27 ft-6 in. above this floor and is supported by the tubing, being free to rise as the tubes expand with temperature. The total rise from cold to the operating condition is of the order of ¾ in.

The furnace is arranged on the north side of the boiler and is bounded on the south side by a curtain wall of plastic chrome refractory built into a row of stud tubes connecting the steam and lower drums. The space to the south of this curtain wall is occupied by the superheater and a double bank of 2-in. convection tubes. The combustion gases pass to the rear of the furnace and round a wing wall which is a continuation of the curtain wall, and then take a turn and after passing a slag screen of widely spaced water tubes continue through the superheater and the convection tubes.

The superheater is the drainable type having three passes with inlet intermediate and outlet headers carried on brackets to the south side of the lower drum. The superheater is in two stages. The steam takes up a certain amount of superheat in the first two passes and then detours through a cartridge type desuperheater just outside the boiler setting, and is there partially desuperheated before passing to the third pass of the superheater where it is finally heated to the desired total temperoture specified as 815 deg. F. The object of this arrangement is to ensure that, while the degree of superheat is maintained at the desired point at any moderate rates of boiler output, it will be limited at high rates of output or under abnormal conditions to a temperature safe for the operation of the turbine. The control of the water fed for desuperheating is effected automatically by means of a temperature controller and in practice results in the maintenance of superheat temperature within 10 or 15 deg.


Placing generator tubes.

The gases of combustion after passing through the remaining convection heating surface continue on to the air heater.

The air heater consists of a rectangular chamber of steel plate enclosing 1,440-2½ in. diameter tubes, 12 ft. long arranged vertically between tube sheets and having a total surface of 11,310 sq. ft. The gas enters at the top at the east end, passes downwards through the first bank of tubes and then upwards through the second bank leaving at the top at the west end. The air going to the burners makes one pass horizontally outside the tubes from west to east.

Air is supplied by a forced draft fan delivering through a short duct to the air heater. The fan is a single width double inlet type with a capacity of 38,400 cu. ft. per minute at 7.4 in. static pressure at 105 deg. F.; or 161,300 lb. of air per hour. The fan is equipped with radial inlet vanes arranged to be controlled from the boiler control board. It is direct driven, through a pin type coupling, by a 75 h.p. 1,150 r.p.m. squirrel cage motor, protected type, normal starting torque, low starting current.

The gas, after leaving the air heater, passes directly to a Prat-Daniel tubular dust collector arranged on the floor 43 ft. above ground level. This is rectangular in shape and contains a number of cyclone tubes designed to separate out about 85 per cent of the dust carried by the gas. The cleaned gas leaves the dust collector on the top and a duct conducts it to the inlet chambers on both sides of the induced draft fan.

The induced draft fan is located on the same floor as the dust collector. It is the half double width, double inlet type with a heavy shaft running in heavy spherical roller bearings on pedestals supported on concrete plinths outside the inlet chambers. It is fitted with steel plate scroll liners and wheel wearing beads and plates. The capacity is 207,000 lb. of air per hour with a static head of 9.68 in. water gauge at a temperature of 415 deg. F.

The inlet chambers are fitted with inlet louvre dampers arranged to be operated from the control board. The fan is driven by a 200 h.p. 1,170 r.p.m. squirrel cage protected type motor with normal starting torque and low starting current.

Both fan motors are arranged with enclosed full voltage magnetic starters with overload and undervoltage protection, so that they can be started or shut down by push button on the boiler operating floor.

The induced draft fan discharges vertically into a Custodis radial brick chimney built on the roof directly above the fan outlet. This chimney is 60 ft. high above the roof and has an internal diameter of 4 ft.-6 in. at the top. It has an inside lining for the lower twenty feet separated from the main shaft by an air space.

The pulverizers are two in number of Babcock and Wilcox Type E. This pulverizer consists essentially of a pair of steel rings between which travel a set of steel balls 9¼ in. dia. The lower ring rotates, carrying the balls with it, while the upper ring is stationary being pressed down upon the balls by adjustable springs.

Coal is delivered to the pulverizer by means of a table feeder driven by a ½ hp. two-speed motor, arranged to be controlled from the boiler control board.

Warm air derived from the air heater is delivered to the pulverizer by a fan, this lifting the finely pulverized particles and conveying the air and fuel mixture through a fuel pipe to the burner. This constitutes the primary air supply. A 100 hp. 1,800 r.p.m. induction motor with high starting torque and low starting current drives both the fan and the pulverizer, the latter by means of a V-belt drive. This motor is provided with an enclosed magnetic full voltage starter, with overload and undervoltage protection, so that it can be started and stopped by push button from the operating floor.

The pulverizers are located on the ground floor, 15 ft. below the operating floor, and with their feeders approximately vertically below the outlets of the coal bunker hoppers overhead. The coal is delivered from the hoppers to two Richardson coal scales, one for each pulverizer. These scales automatically weigh and register the coal in batches of 200 lb. and deliver it through a chute to the feeders of the pulverizers. The mechanism of the coal scale is arranged to halt the delivery of coal until it is called for by the feeder.

Each pulverizer is designed to grind 7,600 lb. per hour of Dominion coal with a grindability factor of 65. The capacity of the two pulverizers is considerably in excess of the requirements of the boiler steam output. This was arranged deliberately to allow some margin in case of using poorer grades of coal or coal with a higher percentage of moisture. Furthermore it makes possible a greater steam output with one pulverizer out of service. It has been found possible to generate 80,000 lb. of steam per hour, or 72 per cent of the rated capacity of the boiler with a single pulverizer.

The burners are two in number, each fed by its own pulverizer. These are set one above the other, in a windbox in the front of the boiler furnace to which heated air known as secondary air from the air heater is brought through a duct with a cut-off damper for each burner. The primary air with the coal dust is fed into the furnace through an 11 in. dia. burner pipe. The secondary air is fed in around the burner pipe and unites with the fuel stream to maintain combustion in the furnace.

With these burners it is possible to vary the rate of combustion through a fairly wide range. Below a certain rate the combustion becomes unstable, and the flame is apt to blow out, like a match in a high wind. The low limit specified as applying to one of these burners was at a steam output of 30,000 lb. per hour under automatic control, which could be reduced to 20,000 lb. per hour by resorting to manual control. In practice it has been found practicable to maintain combustion down to 15,000 lb. per hour of steam. Below this rate, it becomes necessary to resort to intermittent firing, with some sacrifice of uniformity in steam pressure and temperature.

An oil lighting set is included as part of the boiler room equipment. This consists of an oil tank upon which is mounted a motor driven pressure oil pump. This is connected by a length of flexible tubing to a lighting off torch which is kept in a convenient position on the burner platform so that it can be inserted through a burner peep hole into the path of the fuel stream.

The boiler and superheater are furnished with ten soot blowers, piped from a saturated steam connection in the steam drum. These are manipulated by chains from the boiler operating floor.

Safety valves are provided to meet the requirements of the Boiler Code on the steam drum and at the superheater outlet. The latter is supplemented by an Ashcroft power operated safety valve on the superheater outlet designed to deal with any fluctuations in pressure arising in ordinary routine, thus saving the wear and tear on the main safety valves arising from frequent opening and closing.

Boiler Control

On the boiler operating floor is set an operating board consisting of six panels. On these panels are mounted the Bailey instruments and recorders indicating the conditions prevailing throughout the boiler unit. The panel board is located along the east wall of the boiler room facing the boiler front. It stands out three feet from the wall, allowing convenient access to the numerous working parts and fittings on the rear of the board. The instruments are flush mounted on the front of the board, so that they can be readily observed by the chief operator. From the same position he has a general view of the burner heads, and can also observe the Bi-color water level gauge which reflects the actual boiler water level in a suitably located mirror.

Besides the indicating instruments the panel board has mounted upon it push button stations, valves and adjusting knobs and relays for remote control, by means of compressed air, of all auxiliary boiler equipment. Air for this purpose is supplied by a motor-driven compressor situated on the ground floor with a receiver. The air is piped to the control board through filters designed to remove all traces of dust, oil and moisture which in time would affect the functioning of the control mechanism. An emergency air supply is also provided from a compressor in the old steam plant.

The instruments provided on the board are as follows:

- Steam-flow air-flow recorder
- Steam pressure and feed pump pressure recorder
- Steam temperature recorder
- Feed water flow and temperature recorder
- Boiler water level recorder
- Temperature recorder for gas and air through air heater.

Also a set of draft gauges indicating:

- Differential indicating air flow to each pulverizer (2)
- Differential across the fuel in each pulverizer (2)
- Secondary air pressure
- Suction in furnace
- Suction at boiler uptake
- Suction leaving airheater.

Push buttons are arranged for starting and stopping the pulverizers and the forced and induced draft fans. Indicating ammeters are provided on each of these circuits.

Controls are provided on the boiler panel which can be set for either remote manual, or complete automatic, operation of the boiler. The dampers on the induced and forced draft fans, and on the blowers supplying primary air to the pulverizers have local air powered operating devices which can be controlled from the board. Mounted on the board also are pulverizer feeder controllers which act to start or stop the motor driven feeders which regulate the supply of raw coal to the mill in response to the amount ground up and drawn away by the primary air. Since the complete unit is calibrated so that coal fed is a function of primary air supplied, the operator can vary at will the rate of combustion in the boiler by operating damper controls. This he can do by adjusting each individual damper setting manually, or alternatively by putting them all under automatic control. The starting point of this automatic control is the steam pressure at the superheater outlet. Changes in pressure at this point are conveyed to a master controller, which in turn sends impulses which change the opening of the induced fan damper, and at the same time correspondingly adjusts the primary air, and consequently the supply of fuel to the burner. The forced draft fan inlet vanes operate following the induced draft, to maintain a slight suction in the furnace.

The master controller working all the individual controls in unison tends to maintain a constant pressure at the superheater outlet. Because the furnace is almost entirely water cooled, there is very little residual heat stored in the setting and changes in load demand rapid responses in rates of combustion. With a load increase, pressure tends to drop; the master controller receives an impulse and adjusts the individual controls to effect an increase in combustion which will restore the pressure to normal.

Each of the individual controls can be released from the master and operated manually, should abnormal conditions arise and require special handling. Furthermore the master controller can be set for manual operation and the individual controls handled manually. This is done in starting up the boiler or taking it off the line, or when the demand for steam is so low that it becomes impossible for a burner to maintain stable combustion and it becomes necessary to resort to intermittent firing.

Interlocks are arranged so that the forced draft fan cannot be started before the induced draft fan is in operation; and the fans must be delivering air before the pulverizer motors can be started. This is to guard against fuel being fed into the furnace without draft to clear the resulting combustion gases which can give rise to dangerous conditions in the boiler room, or even local explosions in the furnace.

The flow of feed-water to the boiler is regulated by the Bailey three-element control system. This control is actuated primarily by the relation between the water input and the steam outgo, as registered on the meters dealing respectively with those quantities. A cross arm extends between the mechanism of the two meters, so that, when the two meters coincide, the neutral point remains stationary; when however, the meter indications diverge, the movement of this neutral point, through a connecting link, acts to vary the air pressure on the feed control valve and bring the rate of feed back to correspond with the rate of steam output.

The positioning of the feed control valve is affected secondarily by the boiler water level, by means of an averaging relay which modifies the actuating air pressure. This effect is made subservient to that of the flow meters, to avoid violent readjustments of the feed control valve due to swell in the boiler water.

The regulation of the final temperature of the superheated steam is effected by the temperature element in the superheat recorder. This acts to control the air pressure supplied to the diaphragm valve admitting feed water to the desuperheater. The temperature to which the steam is held can be varied, if desired, by the adjustment of a spring tension on the pilot valve.

Feed Pumps

Water is fed to the boiler by one or the other of duplicate Worthington six-stage centrifugal pumps, each having a capacity of 150,000 lb. of water per hour against a pressure of 820 lb. per sq. in. at 3,550 r.p.m.

One of these pumps is driven by an English Electric 550 volt 250 hp. motor.

The second pump is driven by a 225 hp. Moore turbine. Steam is supplied to this turbine at 600 lb. pressure and about 700 deg. F. from the outgoing header of the desuperheater. The purpose of this is to limit the temperature of the steam to the turbine to 750. This turbine is designed to exhaust against a pressure of 60 lb. so that the exhaust can be utilized in the No. 1 hp. feed water heater. Provision is also made for exhausting to the atmosphere.

On the common discharge header of these pumps a relief valve is fitted, arranged to open at 850 lb. pressure and pass 30,000 lb. of water per hour at 910 lb. per sq. in. pressure. This is to guard against overheating of the water in the pump by churning at or near the shut-off condition. At normal rates of discharge the pump discharge pressure falls below the setting of the relief valve so that no excess discharge takes place unnecessarily. The discharge from the relief valve is conducted to the surge tank.

These feed pump units are located on the ground floor of the auxiliary bay. Normally the motor driven pump is used; but the steam driven pump is held in readiness for an instant start in case of any failure.

The feed pumps are normally supplied with deaerated water from the L.P. heater. In the event of any failure of this source a supply line from the surge tank is provided. This line has in it a special weight-loaded valve, so adjusted that it opens only when the pressure in the feed suction header drops 9 lb. below the static pressure due to the surge tank. Normally the pressure set up by the extraction pump is sufficient to hold this valve closed, so that the feed pump does not draw on the surge tank unless the normal supply from the extraction pump and heater fails.

As a final resort, a connection is provided from the City water supply to the pump suction header, by which raw water can be obtained for the feed pump if all other sources are unavailable.

The boiler is fitted with a chemical feed connection, by which the chemical solutions necessary to maintain suitable boiler water conditions are fed into the steam drum by means of a stainless steel internal tube. A mixing tank is set up on a platform on the ground floor under the rear end of the steam drum and a Hills-McCanna chemical feed pump placed alongside feeds the solution through a vertical pipe to the inlet in the boiler drum. The chemical feed pump has two reciprocating plungers driven through reduction gearing from a ½ hp. motor. Its capacity is 7 U.S. gallons per hour against a pressure of 915 lb. per sq. in.

The boiler is equipped with a continuous blow down connection led through an orifice block and control valve to a coil immersed in the surge tank, and then run to the drain. This provides an opportunity to collect samples of cooled boiler water for analysis. It also returns to the system the small amount of heat contained in the blow down.

Besides the continuous blow down, the boiler is fitted with standard blow down valves on the lower drum. In addition, blow downs are provided on the various wall headers and also on the superheater headers. These latter blow downs are mainly for use after periods of idleness when putting the boiler into service. All are connected to a blow down tank outside the building, with a 12 in. dia. vent to atmosphere.

Coal Handling

The supply of coal to the bunkers is by means of a system of belt conveyors furnished by the Jeffrey Mfg. Co. Coal is delivered by barge at the wharf alongside the old steam plant and is delivered by elevator into a storage bin with a capacity of about 2000 tons. From this, the coal is removed by a belt conveyor underneath, which delivers it through a crusher to an inclined bucket conveyor which raises it to the roof of the old boiler house, where it is discharged onto a pan conveyor which distributes it in the overhead bunker of the old boiler house.

While it was desirable to utilize the storage space provided for the old plant, it was necessary to arrange for the delivery of coal to the new bunker without interfering with the existing system, which was needed for the operation of the old boiler plant. After considering various possibilities the scheme adopted was to make use of the existing system as far as the inclined conveyor to the old boiler house. At the head of this unit, a new two-way chute was introduced, by which the coal could be either delivered to the old boiler house, or diverted to a new inclined belt conveyor. The installation of this two-way chute only required the stoppage of the existing system for a couple of days, and sufficient coal was accumulated in the old boiler house bunker to tide over this period.

The second item of the new system consists of an inclined belt conveyor picking up the coal at the two-way chute and conveying it in an easterly direction to a structure built on top of the old boiler house, in line with the centre of the new bunker. The driving pulley at the head of this cross over conveyor is a magnetic pulley to remove from the coal any pieces of tramp iron which might cause a blockage or damage, in the pulverizer feeder or the pulverizer itself.

After passing the magnetic pulley, the coal drops onto an inclined and horizontal belt conveyor which is carried on a truss extending between the old and new boiler houses. The northern portion of this conveyor is carried on transverse beams over the coal bunker. A moveable tripper, running on rails lengthways of the bunker, permits the coal being dumped in any part of the bunker. The movement of the tripper is obtained from the travelling belt through gearing which is thrown in mesh for the forward or reverse motion, or can be locked in the stationary position. The belts handling the coal to the new bunker have a capacity of 40 tons per hour, running at 225 ft. per minute.

Ash Remover

A steam jet ejector system is provided for removing the ash and dust from the boiler unit and depositing it in a concrete ash tank outside the north wall of the boiler house. The ash system used is the Nuveyor type. It consists of a number of 6 in. branch pipes with air intakes, and connections, with cut-off gates, from the hoppers underneath the passes of the boiler, from the air heater hopper, and from the hoppers of the dust collector There is also an 8 in. ash pipe with intakes opposite doors in the furnace ash-pit. The heavy clinker which falls into the ash-pit is raked out onto trays, from which it is fed into the ash intakes. All these pipes connect to an 8 in. riser which conveys the ash and dust to a vacuum tank on top of the ash storage tank. A steam jet ejector sets up a vacuum in the vacuum tank and the resulting rush of air conveys the materials and deposits it in this tank. The steam to the jet is controlled by a valve with an electrical timer which shuts it off for 10 seconds out of every 60. This breaks the vacuum in the vacuum tank and allows a balanced flap valve to open, which permits the accumulated charge to drop into the main tank. When the vacuum is again set up by the jet, the flap valve closes and another charge of ashes is deposited. This action continues as long as steam is supplied to the ejector.

The capacity of the ash tank is 60 tons. To get rid of the ashes without dust nuisance, a "Dustless Unloader" is installed on a platform below the tank. This is an inclined revolving cylinder through which the ash is discharged at a regulated rate and in which it is sprinkled with water sufficiently to settle the dust but not enough to freeze in a solid mass. From the unloader, the ash is spouted into a truck, or possibly a barge tied up to the cribwork.

The installation of equipment was completed at the end of August 1944, as far as essential features were concerned. The boiler was fired up, slowly at first to dry out the plastic covering. It was then brought up to a pressure of about 200 lb. per sq. in. and steam at this pressure was supplied to the turbine for a no load run to dry out the generator. This was continued until the windings showed a resistance of 60 megohms. Next the unit was run up to full speed and on August 19 1944 was first synchronized and cut in on the line, carrying a load of not over 2000 kw. for the first few days. After a few brief shutdowns to make minor adjustments, the load was raised to 6000 kw. and eventually to 10,000 kw. During this period the service engineers made calibrations and adjustments on the control gear and put it in final working order.

It was the intention to shut down the turbine unit after about ten days of operation under load, for a thorough inspection and discovery of any defects before they developed too far. Owing to the critical condition of the hydro storage after the protracted dry season, the energy being supplied by this unit was very urgently needed and it was decided to take the risk of continuing to run, unless definite signs of some irregularity appeared. Fortunately nothing of the kind occurred and the plant was operated under a continuous load of 10,000 kw. until October 21 1944 when it was considered it could be spared for a few days.

The inspection disclosed no major defects requiring a prolonged shutdown and the unit went on the line again on October 30 1944, since when it has been in service continually.

On November 3 and 4, ten-hour tests were made of the complete plant at outputs of 10,000 and 8,000 kw. respectively, observations being made of a number of figures not usually noted in routine operation.

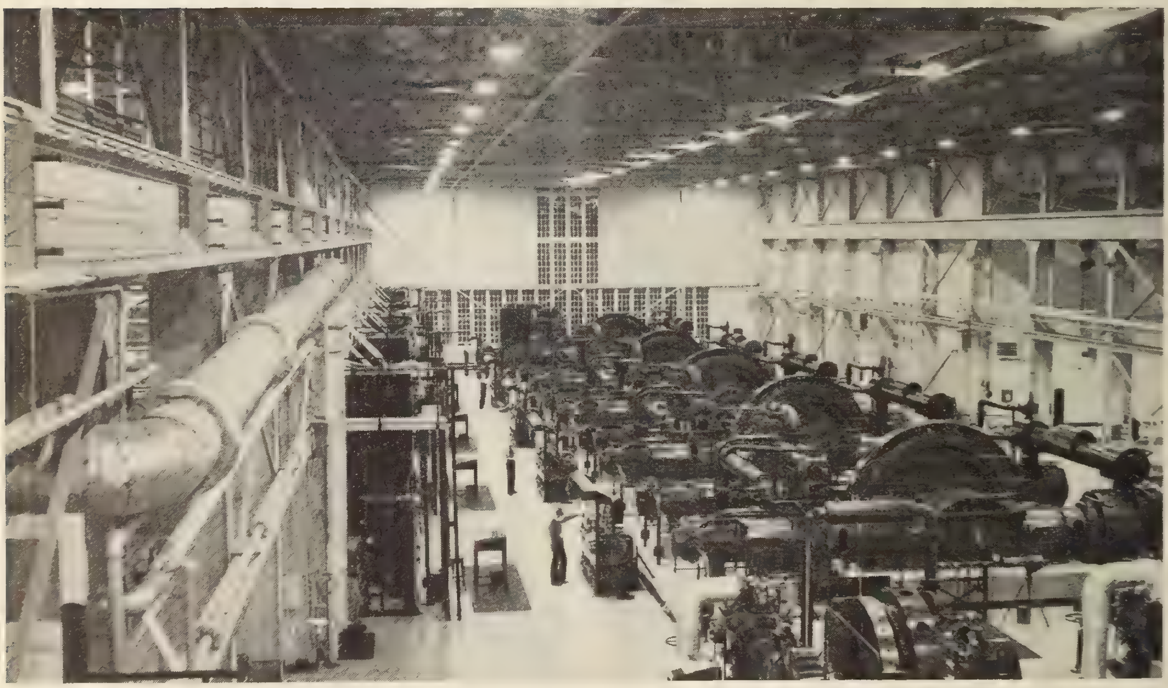
The general results of these tests were as follows:

Date	*Nov. 3, 1944*	*Nov. 4, 1944*
Duration	10:00 to 20:00	10:00 to 20:00
Mean Load (gross)	9890 kw.	8040 kw.
Station Service	527 kw.	488 kw.
Steam	605 lb. 803°F.	604 lb. 803°F.
Vacuum	1.2 in. abs.	1.0 in. abs.
Steam per lb. coal	10.69 lb.	10.65 lb.
Boiler efficiency	87.5%	85.8%
Steam per kwh. (gross)	10.32 lb.	10.06 lb.
Steam per kwh. (net)	10.80 lb.	10.71 lb.
Coal per kwh. (gross)	.964	.945
Coal per kwh. (net)	1.018	1.006
BTU per kwh. (gross)	12889	13012
BTU per kwh. (net)	13611	13853

These tests results confirm, within the limits of experimental error, the expected performance of the boiler and turbine units.

The figures computed from instrument records over the extended runs at normal output show very similar results. The overall figure indicates the production of one kilowatt hour net, that is after deducting the energy used for station service, at a cost of one pound of coal as fired.

RECONVERSION UNDER WAY



An interesting example of how a war industry can sometimes be converted to peace time production is furnished by Canada's ammonium nitrate industry. Manufacturing large quantities of nitrates for explosives during the war, Canada's synthetic ammonia plants are now producing fertilizers to increase agricultural production throughout the world.

The photograph shows one section of the Alberta Nitrogen Limited plant at Calgary. The five high-pressure compressors illustrated were installed in 1941 and 1942 for the production of synthetic ammonia. They are six-stage units, handling a gas mixture of nitrogen, drawn from the air of Alberta skies, hydrogen extracted from Turner Valley natural gas, and carbon dioxide. About one-third of the gas mixture entering the low pressure cylinder is carbon dioxide. This is washed out between the third and fourth stages. The discharged high pressure gas from the sixth stage does not become ammonia until it passes over a catalyst.

The ammonia thus produced will be used for the manufacture of explosives, fertilizers, plastics and other chemicals.

THE UNIFICATION OF SCREW THREADS

HUGH P. VOWLES, M.I.Mech.E.

NOTE:—The following article was received at Headquarters just at the time of the Ottawa Conference on Unification of Engineering Standards. It seemed to have particular significance at this time, and so is being published in the same issue of the *Journal* that contains the account of the Ottawa Meeting. (Ed.)

The screw thread is one of the most fundamental of mechanical inventions. Most early screw threads were formed by hand or wooden spindles. It was not until the sixteenth century that screws of iron and bronze came into fairly general use as metals began to reinforce wood in the construction of machinery. Early in that century Leonardo da Vinci illustrated several devices for cutting screw threads, and in 1578 Jacques Besson described and illustrated a crude form of screw-cutting lathe.

Towards the end of the eighteenth century and early in the nineteenth, Henry Maudslay converted the lathe into an instrument of precision by constructing it entirely of iron and incorporating such novel features as the slide rest with a traversing tool and a lead screw in combination with geared wheels for producing screw threads of any desired pitch. The aim of ensuring greater accuracy in the production of screw threads was followed up enthusiastically by Maudslay's pupil, Joseph Whitworth, who also laid great stress on the need for standardization in the form of threads. In a communication to the Institution of Civil Engineers in 1841 he wrote: "Great inconvenience is found to arise from the variety of threads adopted by different manufacturers. The general provision for repairs is rendered at once expensive and imperfect. The difficulty of ascertaining the exact pitch of a particular thread, especially when it is not a sub-multiple of the common inch measure, occasions extreme embarrassment. This evil would be completely obviated by uniformity of system, the thread becoming constant for a given diameter. The same principle would supersede the costly variety of screwing apparatus, required in many establishments, and remove the confusion and delay occasioned thereby. It would also prevent the waste of bolts and nuts which is now unavoidable. The impulse and direction given to machinery during late years have tended to increase these evils, and must ultimately lead to a change of system."

At that time every maker developed his own pitch and shape of screw threads. The problem of securing some degree of uniformity in Britain alone was formidable enough, without looking further afield; and indeed there was in those days little reason to anticipate the desirability of establishing a world-wide standard. Concentrating on immediate practical possibilities, Whitworth collected a number of examples from the principal British manufacturers, and then designed a standard thread based on the average of those most widely used. His standard thread was rounded at the root and the crest, the sides forming an angle of 55 degs. This eventually became the British Standard (Whitworth) thread. Meanwhile in the United States a different standard emerged, based on the views of the American engineer Sellers, who was president of the Franklin Institute in 1864. In his opinion it was not easy to cut threads at an angle of 55 degs., nor could a fit be readily secured between rounded crests and roots. He proposed instead an angle of 60 degs., combined with flat crests and roots. This is now known as the United States (Sellers) standard. Thus on the basis of the inch system of measurement there are now in existence two "general purpose" standards for screw threads, apart from fine and other threads evolved for special purposes. A third standard, based on the metric system, has been established in a number of other countries.

Rapid progress in transport facilities, a great expansion of international trade, and the ever-increasing demands of mechanized warfare have in recent years emphasized very forcibly not only the pressing need for uniformity in screw thread practice in each country, but also the many advantages that would result from the adoption of a single world-wide standard. The prospect of attaining such a standard is at present remote, owing to the difficulty in arriving at a common system of measurement. A compromise based on the inch system of measurement, on the other hand, presents far less difficulty; and the desirability of such a compromise has been strongly impressed on British and American engineers during two major wars in which their countries have fought together as Allies. The possibility of arriving at a unified British and American system of screw threads was therefore discussed at conferences between Britain, the United States and Canada, held in 1943 and 1944 to investigate problems relating to the manufacture of threaded products. A further conference on the unification of screw threads has recently been held (June 1945) at the Institution of Mechanical Engineers in London, whilst another is now being held in Canada.

These conferences have thrown considerable light on the difficulties arising out of the divergencies in screw thread practice, and the problems to be solved before agreement on a common standard can be reached. For example it was stated by Lord Woolton at the recent conference in London that lack of uniformity in British and American screw threads had cost the Allies during the war as much as one hundred million dollars. It is realized, however, that though the divergencies in screw thread practice are not great, any compromise that may be adopted must necessarily involve heavy capital expenditure. The problem from this point of view is to give practical application to whatever compromise is agreed upon, such that the advantages of unification are ensured whilst capital expenditure and disturbance of production are reduced to a minimum. But apart from economic considerations, it is very necessary to weigh carefully the technical merits of any proposals made, so that sound design shall not be sacrificed in the desire to secure an early compromise. The fact that in Britain the Institution of Mechanical Engineers, in collaboration with the British Standards Institution and the Institution of Production Engineers, have held two more conferences on this subject previous to the autumn meeting in Canada, is sufficient evidence of a general desire to arrive at a result that will be satisfactory from all points of view. There is ample evidence also that American engineers are anxious to reach a conclusion in this matter worthy of the English-speaking peoples who have long been pioneers in the rationalization of screw thread practice.

FOG DISPERSAL FROM AIRSTRIPS

Development of "Fido" (Fog—Incendiary Dispersal of)

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While the British Isles benefit in many ways by their proximity to the Gulf Stream, they suffer many disadvantages from the heavy fogs which result from the climatic conditions.

Cold winds sweeping in over warm areas create fogs which roll in at rates of 15 to 20 miles per hour and envelop the land to a depth of 500 ft.

The flat country extending from the Thames estuary to the Humber is ideal for aerodromes, except for the disadvantage of its soft ground and numerous fogs of the radiation type which are brought about by the rapid cooling of the earth surface bringing a drop in air temperature close to the ground. As a rule these fogs do not attain a depth of over 200 ft., but with the addition of smoke and dust from industry, visibility is often nil, and prior to the development of "Fido", the losses to the country were tremendous.

Pre-war Research

In 1921, some of England's leading scientists stressed the importance of solving the problem but serious research did not materialize till 1936-37.

In the latter year experiments were carried out by the Aircraft and Armament Division and also the Royal Aircraft Section, utilizing a gasoline-alcohol mixture, but were unsuccessful owing to excessive smoke. This experiment was followed by atomization of a mixture emitted from pipe line burners, using 80 per cent alcohol and 20 per cent gasoline. Smokeless burns were obtained but, as far as can be determined, trials were not carried out in fog condition, and consumption was recorded at one gallon per yard hour and some data was obtained on temperatures where such consumption was increased to 4 gals. per yard hour.

In 1939, the Meteorological Section stated that satisfactory dispersal could be obtained by a further increase of heat output. But the project was shelved in 1939 when war was declared.

Houghton and Radford, in the United States of America, carried out experiments using a solution of calcium chloride, sprayed from a line of nozzles, projected into the wind from a height of 10 ft. Some encouraging results were obtained but, from a war angle, the chemicals were not available in sufficient quantities to justify further work on this idea.

It was soon realized that the necessity of keeping aircraft flying under fog conditions was of prime importance if the full use of the Bomber Command was to be realized in Europe.

The use of the strongest available lights proved useless in visibility less than 500 yds.

Experimenting Under War Pressure

In 1942 Lord Cherwell urged that an intensive effort be put forth to solve the problem.

On September 26, 1942, Mr. Winston Churchill issued a memo to the Right Hon. Mr. Geoffrey Lloyd, Minister of Petroleum, as follows:

> "It is of great importance to find means to dissipate fog on aerodromes so that aircraft can land safely. Let full experiments to this end be put in hand by the Petroleum Warfare Department with all expedition. They should be given every support".

The Department, under the direction of Major-General Sir Donald Banks, assisted by research organization engineers, scientists, associated industrial companies and the Canadian Army (R.C.E.) set to work feverishly. All sources of supply in material and equipment were made available with top priority.

It was resolved to find an answer regardless of cost of installation, material or maintenance, although the utmost simplicity was sought.

The standard of clearance established by Air Chief Marshal Sir Arthur Harris stipulated an initial requirement to clear 3,000 ft. in length, 450 ft. wide, to a height of 100 ft. Bomber Command at that time were using Wellingtons and Hampdens.

The Americans made available data covering all experiments which had been carried out in the United States, such as the calcium chloride principle, moisture filtered through muslin, the use of electrical devices, but all were too unwieldy and presented obstacles to the aircraft.

By trial and error it was concluded that heat developed along the runway from some type of burners was the simplest and surest idea if smoke could be eliminated.

Other projects were proceeded with, such as burning coke in troughs, which proved that with sufficient heat output fog could be satisfactorily cleared. Such an installation in regular use had the disadvantages of excessive cost, objectionable obstacles on the landing field, and lack of rapid control in the event of enemy attack. Enemy raids at this period were infrequent and they evidently failed to detect our large scale experimental burns.

Hot air jet systems, heat blower units, Butain gas, and a variety of fuel burners were tried but failed to justify production, although many ideas would have been practical with sufficient time for their development.

The experiments were spread over a large area, in localities as far apart as Hampshire, Derby, Sussex, and Cambridge.

The Four Oaks alcohol gasoline burner, which consisted of two diagonally crossed orifices producing a spray conical in shape, was tried but failed due to excessive smoke, although this was greatly reduced by the use of a screen made from perforated gasoline cans. At this stage the goal was in sight if the smoke could be removed. And it was decided to concentrate on standard grade fuels.

Haigas and Haigill Burners

The solution was first arrived at with the development of the Haigas burner, which allowed gasoline to be pre-heated by passing the three feed pipe lines round the burner line in which a series of holes were drilled to act as jet burners, and ultimately modified to a single pipe line to supply two burner lines which directed their flame on the pre-heater. This became known as the Haigill burner.

Graveley air field, on which a variety of burners were being experimented with, was equipped with a Haigill, and, on February 18, 1943, at night and under heavy misty conditions, Air Marshal Bennett landed a Lancaster. He felt that the results justified adoption, and seven other airfields were equipped, consisting of Melbourne, Fiskerton, Blackbushe, Down Market, Bradwell Bay, Ludford Magna, and St. Eval—all chosen to deal with bombers returning from Europe and to provide for fighter and fighter-bomber cover in the south and the east.

Coastal Command aircraft were taken care of under sea fog conditions from St. Eval.

The heavy nature of sea fog caused difficulties brought about by the speed with which it rolled in from the ocean, and it was necessary to install two lines of burners on each side of the runway.

The first successful operation took place at Graveley when four Halifaxes were landed in 19 minutes from a sortie on the 19th of November, 1943. The visibility was 200 yds., the fog depth 50 ft. and the wind ½ m.p.h. from the north.

Fido Under Test

A test burn was carried out at Fiskerton when the whole squadron was landed at night without fog on November 23rd.

Visibility was down to 450 yds. and the depth of fog was given by pilots as 1,500 ft. The ground crew were in a wildly enthusiastic state as they felt that at last they were going to do some good. Practice makes perfect, but practice without obtaining working results gets boring and every man was keen to get going.

The installation was lit at 00.15 hours and as the flames rose higher and higher on the initial light up, swarms of birds flew round and round in a confused state above the runway, and rabbits scampered hastily along the field in an endeavour to get out of the box of flame.

Buildings and then trees gradually appeared out of the fog as though they were creeping like ghosts into the picture.

An unnatural light was cast everywhere. Foliage on the trees showed a verdant green in a reddish atmosphere, the crashtenders' brass gleamed as the crew of ruddy faced men stood at the alert, while in the control tower a tense eagerness reigned in a room filled with the light of the flames.

Radio operators sat at the control panel with hearing tense and a look of alert eagerness; the Commanding Officer quietly asked questions now and again to check up on the situation whilst the landing officer stood at his side.

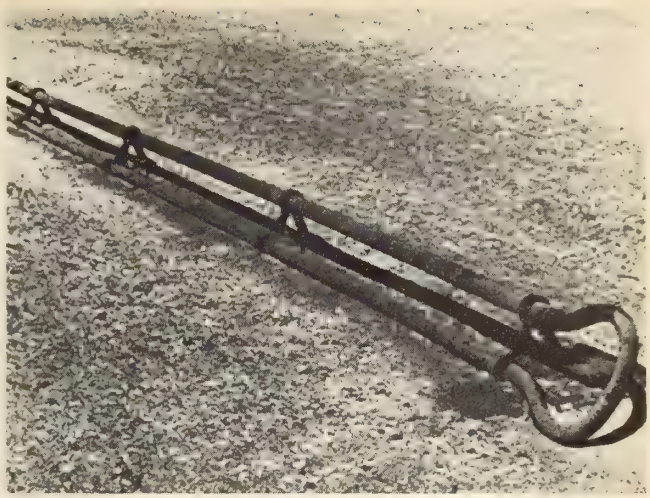
The fog dispersal officer was busy giving instructions for pumping rates and fault correction on burners and checking up with the airfield controller that all was well at his end.

Eyes were strained to catch a glimpse of the first plane as it came down to the runway and the airfield controller called up that the aircraft was just touching down and gave its letter, remarking very shortly afterwards: "Jeez, that was a peach".

From the control tower the view was distorted owing to waves of heat passing into the air and suddenly a dancing silhouette of an aircraft could be discerned taxiing along between the flames. That was No. 1.

Eleven more aircraft followed, all pilots making visual landing and, in the briefing room later, their praise was high.

Remarks such as "Landing conditions perfect" . . . "Glow could be seen 100 miles away over the North Sea" . . . "Touch down clear as daylight" . . . and lastly, "Damn good". The most gratifying remark spoken into the ear of the fog dispersal officer was from a new pilot who said "I'll never take my tooth-brush with me again".



Haigill burner.

At Fiskerton the project was "sold"; all that remained was to spread the gospel, but that was not so easy.

In other quarters beam-minded folk still clung to their ideas and the pup Fido was given a meatless bone, but he had to grow up, and he did.

Fiskerton again pointed the way on the 2nd December, 1943, and landed 16 Lancasters on return from operations at the rate of one every 3½ minutes. Four of these aircraft were from other stations and the landings were excellent.

Various minor points had now to be dealt with. For example, one or two pilots complained of glare, making instrument reading difficult; this was overcome by switching on full cockpit lighting. Others complained of turbulence—these were the pilots who made stall landings; this, too, was overcome by making "wheelers", and gradually all points were ironed out.

About this time it became apparent that Fido would also be useful as an aid to landing in conditions of haze and smoke combined with strong sunlight—a bad condition which frequently occurs in the lee of big industrial cities—by burning the first one or two burners at the approach end of the runway.

Fiskerton succeeded, on the 28th December, 1943, in landing six aircraft which would normally have been diverted in these conditions after several attempts had been made without the aid of the apparatus.

Fiskerton was setting a very hot pace and, as is usual, other stations started entering competition. Gravely, Hartford Bridge and Ludford Magna all carried out operations, but Fiskerton at this time was still firmly in the lead.

Faith was needed in the installation and in the control and fog dispersal officers, and it had to be established.

Control officers were the chosen personnel to put the job over and to maintain the installations. They had been drawn in the main from banking, insurance businesses, and the teaching profession, and were on the average about thirty-five years of age, still alert and young enough to learn and possessing a sense of responsibility.

Their knowledge of local conditions, the thousands of landings they had watched, the faults they had noted in individual landing records, the flying hours they had put in as passengers, and their close contact with the air crews brought about the necessary results.

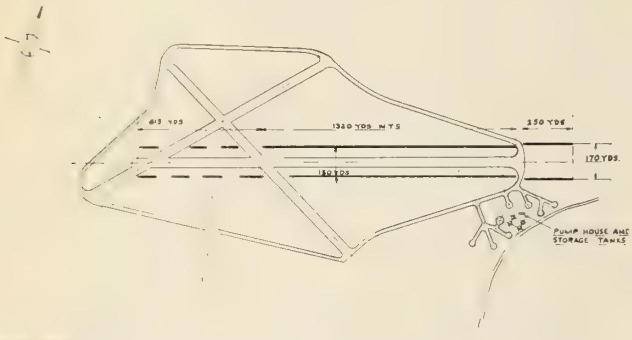
Gradually, Fido became known in the ranks of the R.A.F. and many air crews owe their lives to it.

The Americans in the European theatre of operations were not familiar with it, and when eleven aircraft were diverted one afternoon to a Fido airfield only one—a straggler—arrived there. The others took a chance and flew on, luckily out of the fog zone at that time and managed to land before that area, too, closed in.

Lieutenant Jacoby was flying a Dakota (C47) and made base area only to find fog blanketing everything. After making contact with the tower he was told to go to Fiskerton which instructions he accepted and accordingly set course.

In the control tower at Fiskerton, F/Lt. Bone could hear the instructions and waited for a while until the aircraft got near to the burning installation, when he gave clear and precise landing instructions.

The pilot was not happy and asked for a diversion station, to which the reply came there was none. He said "I'll take a pass at it" and then came the long period of waiting.



F.I.D.O. installation—typical layout.

Conditions outside had deteriorated in the meanwhile. Cloud was right down to ground level and a wind of 20 m.p.h. was whipping the fog across the burners at such a rate that only an archway about 100 ft. above the runway could be cleared.

The light from the installation glowed through the fog as a bright pink rectangle from above as Jacoby came in to land.

His first effort was across the runway instead of along its length and he had to be rebriefed.

In the meantime two burners had burst letting in fog in big gulps and, in an effort to stem this, the fog dispersal officer opened up the valves either side of the gap to get a bigger flame. This partly helped but the fog intrusion was still apparent.

Another approach was made, this time over the eastern end of the runway at about 50 ft., the plane going directly over the petrol tanks. More briefing ensued.

At the third attempt Lieutenant Jacoby had it lined up and he came in to make a good landing about 600 yds. along the installation. The time taken was twenty-two and a half minutes, and he said he could have done it quicker if he had known what to expect and what to do. This was the first U.S.A.A.F. aircraft to use Fido.

This again stressed the value of briefing and a report was put in to Group Headquarters to that effect.

Conversion flight schools, finishing schools and operational training units were urged to send aircraft overhead when test burning was taking place in order to give new pilots an idea of what to expect in the way of layout. This subsequently bore fruit.

At a later date, July, 1944, Woodbridge came into operation. Here a double line of burners was employed on either side of the runway owing to its unusual width (three normal runways in one) and a four-line approach cross line was installed.

This was probably the busiest station in the United Kingdom on an operational night, and later it came to be used extensively by day by the U.S.A.A.F., for emergency landings.

Fido here more than proved its worth and the station holds records which show that no less than 185 aircraft landed in one day with Fido doing its work. A very large proportion of these aircraft were American.

Fido was also provided at the emergency runways at Carnaby for No. 6 Group (Canadian) and at Manston, No. 11 Group (Fighter); these stations, too, proved their worth.

Woodbridge has, on occasion, employed the apparatus to raise the cloud base, an all-important thing with heavy traffic in the vicinity.

A typical report is as follows:—

> "Wind (West 10/12 m.p.h.) remained in a westerly direction resulting in good clearance at the east end of the runway both inside and outside. Low stratus, base 500/600 ft., tops varying 800/1,000 ft. persisted almost throughout, but on occasions patches of blue sky were visible at the east end of the runway due to the effects of the burn".

Visibility was improved from 1,500 to 3,000 yds.—2 miles. In an area unaffected by the burn, visibility remained at 1,500 yds.

The duration of the burn was from 11.35 hrs. to 19.30 hrs. during which a mixed bag consisting of Halifaxes, Lancasters, Oxfords, P51's, P47's, B17's and B24's were landed, totalling 86 in number.

This total included many damaged aircraft and others suffering mechanical defects. Troubles such as heavy flak damage to the undercarriage, two motors unserviceable, elevator and rudders unserviceable, elevator and rudders unserviceable and turbo control wire broken, could be applied to seventeen of the total without mentioning those short of fuel.

In this case an improvement in visibility of at least 1,500 yds. and the breaks in the cloud, rendered a great help in landing the aircraft safely.

Application to Civil Aviation

It is felt that Fido has come to stay. The immense advantages it offers, particularly to civil aviation, are apparent.

Passengers require to be delivered to their destinations by air and nothing is more annoying that to have to complete a journey which was started by air, on board a train.

The author's opinion of Fido is based on the experience of being up in a Liberator with all stations fog bound for a thousand miles. But Fido did it!

Petrol has to be carried in excess of the normal requirement if there is a chance of diversion at the end of the journey; this cuts down the pay-load weight and for these reasons alone Fido is worthwhile quite apart from probable reductions in insurance premiums which might result from the removing of fog hazard.

During the war period, Fido has more than paid for the great outlay in expenditure, and very valuable experience has been gained.

In the days of peace when this aparatus can be used more sparingly, it would prove a blessing to pilots generally, and particularly to those on trans-ocean routes where long distances are often covered only to find the airfield at the destination unusable.

Up to the 31st of March 1945, no less than 2,444 aircraft have made landings on Fido installations in the British Isles, a quarter of the total being U.S.A.A.F. aircraft. Apart from this 181 aircraft have used the installation for take-off on operational missions and patrols.

A Fido installation was made in the Aleutian Islands by the U.S. Navy and put into operation at the time of Mr. Roosevelt's visit. The author acted as consulting engineer on this job which proved successful and justified further installations.

From observations taken by the meteorologists, it was found that apart from a condition where the geostrophic wind was dragged down on to the runway, the following burner arrangement could be effectively used to clear fog.

For a crosswind, the line on the windward side only need be operated; this provided a good clearance across the runway and downwind.

In calm conditions, as near a box formation as it is possible to employ around the runway should be used.

With a wind parallel to the runway the side lines and the cross burner upwind should be operated.

These are broad principles, but they can generally be applied with success and although wind conditions for each operation differ to some extent, this basis holds good.

General Layout of a Fido Station

The installation on the field consists usually of about 1,300 to 1,400 yds. of continuous line with only 15 ft. gaps between burners, and isolated burners set at every 80 yds. from thereon to the end of the runway. The latter are only installed as an aid to taxiing.

The main runway is usually chosen for setting out the installation as it is invariably 2,000 yds. or more in length.

An approach box extending 250 yds. (normal) and possibly 500 yds. (exceptional) is laid at the approach end and the sides of this box are slightly wider (10 ft. on each side) than those running beside the runway.

Burners are laid on the ground level. 50 yards from the runway in the case of most airfields, and they form very little obstruction. Heavy aircraft such as Lancasters, Halifaxes and Stirlings simply flatten a Haigill line if they run over it. Oxfords and even Spitfires have crossed the lines without coming to grief.

Tankage

Tankage varies according to the size of the apparatus, and most installations hold about seven hours' supply, which amounts to roughly 2,000 tons. Most stations contain this fuel in three or four tanks usually placed at a safe distance on the left hand side at the Fido approach end of the main runway. Each tank is surrounded by a brick curtain fourteen and a half inches in thickness. These curtains were designed to protect the tanks against blast.

Fuel Supply

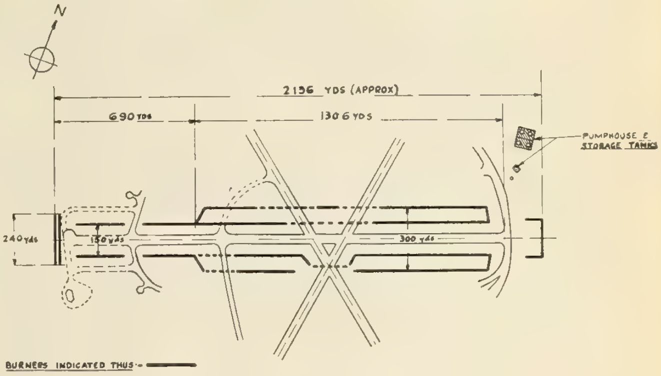
Fuel supplies are brought up by rail (in roughly 100,000 gallon batches) or by road tankers. In the case of rail head supply the fuel is pumped at the rate of 500 gal. per min. by means of a drum pump through lines connected with the airfield directly into the tanks. Road supplies are unloaded at a special bay adjacent to the tanks, where five headers enable the same number of road cars to be emptied at the same time. In this instance the field pumps are used to feed the spirit into the tanks.

Pumps

Most installations are fitted with six Sulzer pumps modified for fuel pumping, five of which are connected and one is held in reserve. These five pumps are capable of dealing with 2,500 gal. per min. when they are all employed, and most pump-houses are so laid out that it is possible to draw in supplies and feed the field line at the same time.

Control House

From the pumphouse a header is run to the control house where the line is divided into three separate channels, one feeding the left side, one feeding the right side and the other supplying fuel to the "approach box".



F.I.D.O. installation—special layout.

Field Lines

Field lines, of course, vary in size, according to the layout on each particular airfield. These lines are buried at about three feet depth, and seventy-five yards back from the runway, and are fitted with drain off valves at low points and air vents at the high points.

Pipes are fitted at the required interval carrying the fuel to hand control valves at ground level. A thirty pound shut-off valve and a pressure regulating valve is also installed at this point, which feeds to four burners. This valve also stops any fuel feeding back when the pressure in the burner line becomes greater than the feed from the supply.

Burners

The burners themselves vary in size at most places according to the type supplied. Mark V. burners, i.e., the latest type, are each 60 ft. in length.

The fuel is carried to the centre of a 2 in. pipe forming the preheater, which is elevated about 7 in. above the two 1½ in. burner lines, forming a triangle of piping when viewed end on.

The jet holes are 36 morse and are so arranged that the flames play on the preheater pipe to vaporize the fuel.

Operation

When starting up, the pumps are turned over at a low speed and a recirculating flow is set up to avoid hammering in the pumps. The flow is then balanced on each pump and the pressure raised to 60-70 lb. per sq. in. depending on the levelness of the field, more pressure being required when the airfield has a considerable slope.

The field control valves are then opened and the recirculation is closed. Hand valves on the field line are opened, and when the spirit flows from the burners it is ignited either by hand or by a small flame device set at the lowest point.

As soon as the flame has spread the whole length of the burner, the supply is closed off. The reason for this is that the cold spirit gives off smoke, and a period is required for the fuel to vaporize. A strong pressure is built up during this period and the non-return valve comes into action stopping any back flush to the hand shut-off valve.

After approximately 1½ to 2 minutes the flame begins to die down and a clear flame from the vapour is obtained. At this point the hand valve is again operated and fuel is fed steadily until the valve is fully open. By this means, a clean steady flame is obtained.

Simplicity of design is general throughout the installations.

Ignition

A small by-pass is also incorporated in the design to permit the installation to be operated at an idling pressure if required.

This project, of course, suffered the usual "growing pains" and, in an endeavour to cut down labour and to secure automatic relighting, a coil burner consuming only a small quantity of petrol was added to the line to act as an automatic igniter. This coil worked off the by-pass supply at about 15 lb. pressure.

It was a failure from the start. The steel was too malleable and, since the coils were suspended with very little support—about 6 in. above ground level—they sagged. The fuel which jetted over the top of the coil burned fiercely on the ground giving off pillars of smoke, and they were finally removed after persistent complaints from the operating stations.

Dietz torches, such as used on city sewer and road work (named "footballs" by the Department), were installed at most airfields with Haigall burners. These are placed in such a position that fuel flowing out of the burners readily ignites, thus saving labour and time.

In this case, all valves are left permanently open on the field and control is effected from the control pit or pump house.

With this method, a uniform light up is obtained. There is always more initial smoke than when each burner is hand controlled.

Covers have been made for the torches so that the flame does not show up when fog is not prevalent. This is necessary as these flames present a flamepath, a part of which is undershoot area.

Results

Clearance of fog in the runway area usually takes about four to seven minutes. No clean cut pattern can be guaranteed, as results depend on wind conditions. In many cases, a clearance of about one mile on the approach is obtained when the wind is parallel to the runway.

We have dealt mainly with the Haigill which has reached its fifth modification.

In the Mark V. type, expansion now takes place inwards, whereas on previous models is was outwards. There was a persistent tendency to pull loose from the anchor blocks in the earlier models due to the spreaders gripping the unit during expansion. The spreaders on this model have been increased in number and have been made slightly larger to prevent gripping.

I.R.B. Burner

In order to maintain a continuous line, another type of burner had to be employed where runways intersect. The type of burner used was named the Intersecting Runway Burner.

This burner is absolutely flush with the runway and forms no sort of obstruction except at the vaporizer. This consists of four vaporizer tubes and two burner lines which feed vapour into a pipe 4 in. in diam. which is built into the runway between guide rails.

Some trouble had been experienced with these as water very often collects in the burner line and small stones jam the pipe causing it to hump. Experiments with various types of channelling were carried out to overcome this fault.

Hades

A burner has been developed on much the same lines as the I.R.B. but it is a much larger job and is *all* submerged in the ground. This is known as the "Hades".

Its total length is 300 yds., but it can be varied according to requirements. Final output figures are as follows: it burns well at approximately 80 therms per yd. hr. with a consumption of 260 gal. per min. for a 240 yd. burner.

The test burner at Staines was operated 120 times without any sort of trouble.

A good feature of the automatic starter with a completely automatic build up to full burning by means of electric valves controlled by a syn-clock. Warning lights are fitted in case of failure of the igniters.

Hades Layout

In this model, vapour is supplied to the line by 14 preheater pipes heated by a single burner, which has a separate feed from two other preheater lines.

The vapour is fed into a trap pot which is not baffled as previously but is quite deep. From the pot the vapour goes directly to the burner line which is 200 to 300 yds. long and is swaged from 8 to 6 in. pipe after 200 yds.

A catch pot is operated at the far end of the line to collect any condensate. This can be pumped out or burned off.

On the model at Staines, a self-pressuring feed carries this fuel to a series of coils where it is revaporized and burned off in a smaller line running parallel to the burner. This arrangement has not been perfected and some smoke is occasionally given off, but it is never serious.

The Hades has only one serious disadvantage, and that is if the vaporizer bursts, 300 yd. of line will be extinguished and this constitutes a serious gap, but if the same record of burning were produced in the field as on the experimental station it was thought there would be very little to worry about.

Rapex

This burner is identical with the Hades except that it is laid across the runway and a blow back and diversion pipe has been fitted.

On turning two valves controlled by one handle, the flame can be diverted from the main burner line to the diversion pipe parallel with the runway.

This works very well, but the problem again as in the case of I.R.B. was the introduction of a conduit which would prevent water from draining into the burner line.

Gravel and runway sweepings also form a danger inasmuch as they sometimes wedge in the line supports and clamp the burner line.

Therefore a design is required where the pipe can be flush with the runway surface without admitting water and grit.

Slot Burner

This is the neatest job yet produced and is absolutely level with the ground, as the burners are all below the surface and a metal grid is fitted over the top.

It has the advantage of being electrically controlled, with an arrangement so that only selected sets of burners need be put into operation. A tell-tale panel is fitted in the control tower and at the control point.

An entirely different principle has been adopted in design. Each section is 10 ft. 6 in. long, and these are arranged in blocks of 70 yds.

Each burner consists of a hairpin pipe and the upper portion contains an inner tube of copper which gives a spray feed, and the lower portion is the burner.

Full output will not exceed 35 therms per yd. hr. The installation must not be worked below a pressure of 35 lb. per sq. in. as the burners become fouled when using leaded fuel (50 lb. per sq. in. is normal operating pressure). On the other hand, after ten minutes full burn, the apparatus will retain heat for fully ½ hour and the whole lot can be relit smokelessly by pressing the button and feeding the fuel gradually. The first installation was laid out at Blackbushe.

Portable Burner

In November 1944, a demand arose for a comparatively lightly constructed outfit and this demand was met by the introduction of the portable burner. These were installed in France for the T.A.F.

Layout—The whole construction is above ground and is anchored at intervals by the use of easy fitting clamps mounted on metal scaffold poling which is driven into the ground.

The vaporizers consist of a series of 6 coils which feed a 2 in. line of 76 ft. in length.

Twenty-one double burners are sufficient to cover 1,200 yd. and provide a cross burner, and the whole lot including pumps—but excluding tanks—weighs about 90 tons.

These burners produce 29 therms per yd. hour and each section can be hand operated so that it is possible to use only two burners as markers if required.

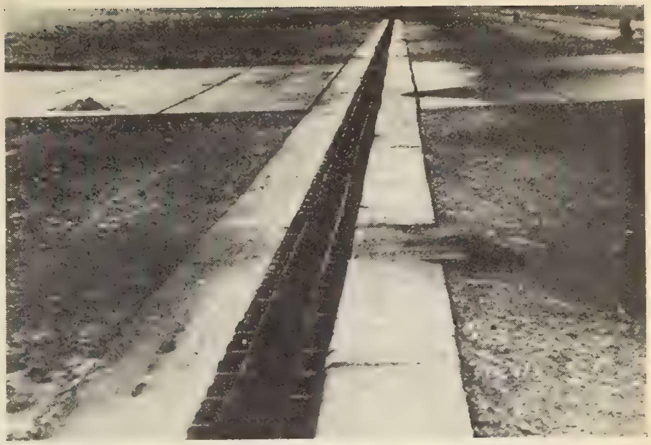
Distortion of the actual burner line does not matter in this case, as any curvature which takes place is flat on the ground surface.

Another improvement is the screw connection making it possible to replace burner line without welding.

It was planned to light the whole line by the use of Dietz torches set into the ground between the vaporizers.

Emergency Repair — The experimental work was done on a coil similar in design to the portable, for use as an emergency repair burner for the Haigill installation.

In the event of a burner line break, the vaporizer would be screwed on to the feed line just behind the permanent burner.



Slot burner.

The difficulty was to produce a coil which would work at the same pressure as the Haigill.

Markers

In response to a request for flare path illumination in conditions of poor visibility due to smoke and strong sunlight, a small transportable marker has been produced.

This consists of a small two coil unit feeding a burner 30 ft. in length. Fuel is fed by a hand pump from a 50-gal. barrel at the rate of 1½ to 2 gal. per min. giving about 25 to 33 minutes burn per barrel.

This marker gives illumination equivalent to a bank of sodiums 5 ft. in height and the same length, and has proved so successful that demands for the installation were coming in every day.

A small self-pressuring marker had also been produced. This consisted of a steel cylinder containing roughly 50 gallons of fuel with two burner coils mounted on the top, and a small length of a burner which spreads its flame on top of the cylinder.

This marker burns for about 30 minutes, expending roughly 44 gallons of fuel in that time, and proved quite as satisfactory as the hand pumped apparatus.

The whole outfit with the exception of the burner line and coils is flush with the ground but forms an obstruction of about 10 ft. in height at the point where the coils are situated, which is really negligible.

A development in Marker burners had led to their use as approach path indicators.

In this case no less than 9 standard (30 ft.) markers are employed. The first is placed at approximately 125 to 200 yds. from the end of the runway, and at right angles to it. The rest are assembled in " V " form and are placed at 500, 1,000, 1,500 yds. from the touch down point and the last " V " is set out on the curved approach approximately 1,800 yds. out

These burners are connected by a 1½ in. line to a fuel tank and are operated off the built-in pump at a pressure of 8 to 10 lbs.

Drillings are 3/32 in. at 6 in. intervals in a one inch line in groups of 3 at 3/16 in. intervals.

This pattern was not made to clear fog but to be employed for its light value. The 8th Air Force in the European theatre were not stinting in their praise.

Tunnel Burner

Work was also being carried out on a tunnel burner which consists of a coil within a tunnel feeding a single burner line. Automatic control is now possible with both the Hades and the Slot burners, and in new installations this was regarded as an essential.

Diesel

As yet no attempt has been made to produce a diesel burner in England and all efforts have been concentrated on the production of better petrol burning units. This was due in part to the urgency of our requirements.

American Development

On this side of the Atlantic only experimental work has been carried out, with the exception of one unit where a Haigill installation with one or two modifications has been laid out. A different and better designed spreader has been employed and the method of anchoring also differs. This apparatus has been installed as near to perfection as possible.

Todd Burner

The Todd Shipbuilding Company, under commission from Budocks, have produced a burner employing boiler principles and using Diesel oil.

The burner line consists of manifolds which vary in size from 14 down to 10 in. in 20 ft. lengths, in which nozzles 1 in. dia. are inserted at 5 in. centres.

Fuel is fed to a combustion chamber heated to about 800 deg. F. and a further supply of fuel is injected forward of this position by 14 nozzles fitted with sprayer plates. This atomized fuel soon becomes preheated and drives forward to the manifold under expansion aided by a fan draught. Ignition in the combustion chamber is obtained by means of a flamethrower type ignition set.

The equipment is heavy as each unit requires two 75 w. Diesel D.C. generators, a 50 hp. electrically driven fan, a 25 hp. electrically driven pump, a 1 hp. electrically driven fuel oil service pump for the combustion chamber burner, a magneto and air compressor lighting effect.

This equipment could be fined down on a field installation, but the fan and its drive, the small fuel service pump and a compressor magneto set would still be required for each unit in addition to a field pumping installation feeding to all burners.

Although this burner functioned very well, it is thought to be expensive to install and rather complicated machinery to go wrong in addition to the necessity for a large pit close to each burner which might form a serious hazard to aircraft.

St. Clair, Rouse and Croft Burners

These forms of burners are identical in principle. They all employ a system for preheating the fuel (Diesel oil or gasoline) in much the same way as the Haigill, except that six pipes are required for the preheating stage.

This method of producing a flame from Diesel oil is unsatisfactory as there is always a long period when black heavy smoke is given off after the initial light up and in many instances it persists for ten minutes, after which a good clean flame appears.

Thermal outputs as high as 90 therms per yard hour have been obtained from very flimsily constructed burners without too much distortion but on closing down it is usual to have large pieces of carbon floating in the air.

To overcome a smoky light-up, Dr. Rouse starts up with gasoline to obtain rapid preheating and this does in some measure cut the smoke down.

These burners do the job but they are all far from ideal.

Babcock and Wilcox Burner

This burner is the most simple type yet produced, it is easily constructed and is adaptable to broken terrain and its possibilities are generally good with the exception that it produces too big a flame.

It consists of a trident of nozzles, set at 52 deg. apart (standing about 1 in. from ground level) into which are fitted marine boiler sprayer plates.

Thermal output is varied from 52 to 120 therms per yd. hr. according to the place employed. At the lower thermal output, the flame is about 4 to 5 ft. in height, at 90 therms 8 to 10 ft. in height, at 120 therms 12 to 15 ft.; pressure in each case is 1,400 lb. per sq. in. at the pump.

For an outboard line, this burner presents no obstacle but if it were employed at the usual distance from the runway, i.e. 50 yards, it might have a bad psychological effect on pilots and would necessitate widening of taxiing gaps which is undesirable.

Once Messrs. Babcock and Wilcox overcome the colossal size of the flame produced by their burner, it is thought that they will have the best commercial proposition from the points of view of construction cost, maintenance, fuel used, ease of ignition, relative absence of smoke and clean extinction.

Other Projects

Experiments were carried out with a sonic device which was heard 70 miles distant but failed to produce the required result.

The University of Iowa have been working on plans for a windslot which is designed to operate with a fuel burning line to save fuel costs.

A projected installation is that termed the water curtain. The idea in this instance is to damp out the fog. It certainly sounds very novel.

Summary

It has been established beyond a doubt that better results have been obtained up to the moment by using gasoline as a medium, but results produced from the St. Clair, Croft, Rouse and particularly the Babcock and Wilcox burners show that Diesel oil can be used with excellent results.

The requirements for an installation which is to be supported by private enterprise are:

(1) Low cost of installation.
(2) Low cost of fuel.
(3) Low cost of maintenance.
(4) Reliability.
(5) Central control.
(6) Division of layout so that selected sections can be burned.
(7) Automatic light-up.
(8) Automatic close-down.
(9) Low (but fierce) flame so that taxiing gaps can be cut to a minimum.
(10) Uniformity of layout.
(11) Good airfield lighting.

The last mentioned item is not considered as part of the Fido installation, but it must be regarded as an essential as the luminosity given off by the apparatus is so intense that without good lighting it is very hard to distinguish the actual runway when landing at night.

THE NEED FOR TECHNICAL INSTITUTES

In Our Educational System

A Brief submitted on behalf of The Engineering Institute of Canada, by C. E. Sisson, a vice-president, to the Royal Commission on Education (Ontario), on September 17th, 1945

The Royal Commission on Education,
Ontario College of Education,
371 Bloor Street West,
Toronto 5, Ontario.

Gentlemen:

The Engineering Institute of Canada is grateful for the opportunity to present its views on one phase of the important problem before you. The Institute makes this presentation only after long consideration of the subject by its Council and by its branches, and after a co-ordination of the ideas and opinions thus expressed not only in Ontario but in all the provinces.

The Institute, with over 7,000 members, is the largest professional society in Canada, and one of the oldest. It is deeply concerned with all matters relating to education, not only with regard to the students in engineering and science but also with regard to the educational status of those in adjoining industrial groups.

Reason for the Interest of the E.I.C.

Although the membership of The Engineering Institute of Canada is made up of professional engineers who have completed an accredited course in engineering or applied science, the Institute has a special interest in the education and training of those with whom the engineers will be associated in industry. Their interest extends to training at the vocational level of those who seek to prepare themselves for the various trades, and even more to those who seek to acquire the education and training needed for the fields of industrial employment lying between the trades and the professional fields.

Views of the Membership of the E.I.C.

In February 1944, a paper was presented to the Council of The Engineering Institute of Canada, by Dr. C. R. Young, a past president of the Institute, on " The Desirability of Establishing Technical Institutes in Canada ". This paper was received with great interest and its contents were considered to be so timely and of such importance that all the branches of the Institute were asked to appoint committees to study its contents in their national significance and with reference to local conditions. From the many committee reports thus obtained it is evident that any steps taken by the Government of Ontario to establish Technical Institutes would be viewed with approval by the membership of the Engineering Institute not only in Ontario but across Canada.

Fields to be Covered

In these reports there was practically unanimous opinion that the field of usefulness of such institutions would be between the levels of the vocational or trade schools and the engineering courses of the universities. It is from this area that industry would be able to fill its increased need for more and better technicians and supervisors. At the moment there are no recognizable training courses to meet this need. This is an open link in the educational chain, that should be filled promptly, if Canada desires to give to its young men and to industry, the opportunity to make their maximum contribution to the progress and prosperity of the country.

The Courses

The Institute does not propose to recommend the course or courses that should be established. There is available to the Commission the advice of educational experts who have studied the problem from the academic angle and who are highly qualified to give such information. The Institute's interest in this instance is largely that of the employer who is concerned with the end product of the educational systems. It is doubtful if any other organization in Canada has in its membership a higher percentage of persons who are vitally concerned with this phase of education. Here are the people who will engage the graduates of such educational institutions.

Rehabilitation

Signs in every direction indicate that a very great number of service personnel are choosing engineering as their post war educational objective. In fact the estimated numbers are so great that the universities are faced with a very serious problem in endeavouring to meet the demand. The Institute is reasonably close to this situation by virtue of its co-operation in rehabilitation matters with the Legion Educational Services, and the Department of Veterans Affairs and the services themselves. From all these contacts it appears that the needs of great numbers of those talking of an engineering course could be met more adequately with a course such as that supplied by technical institutes. It is a serious matter that such courses are not available. The need is there and will increase with startling rapidity in the very near future.

The Council of The Engineering Institute of Canada recommends with great emphasis that technical institutes be established at the earliest possible moment.

Submitted on behalf of The Engineering Institute of Canada.

E. P. Fetherstonhaugh,
President.

DETROIT INTERNATIONAL MEETING

For the second time in two weeks, the Institute joined with The American Society of Mechanical Engineers to hold a meeting. On Friday, October 5th, the members of both bodies assembled in Detroit to tour an American industry and to gather for dinner to hear General A. G. L. McNaughton speak on "Canadian Engineers' Contribution to Victory". The occasion of the previous meeting was in Ottawa, and is reported elsewhere in this issue. The members of the Border Cities Branch and of other Ontario branches, along with representatives from Montreal, joined the members of the Detroit Section of the A.S.M.E. at the plant of the American Blower Company to see the research and development laboratories. It was one of the most interesting industrial visits that could have been arranged. The visitors saw the dust laboratories where samples of air, taken from various sources, were treated in such a way that their dust content was separated and analyzed for the purpose of determining methods by which it could be separated in the original location as an aid to health, comfort and the processes of the industry itself.

Here, as a part of the record, are over 4,000 samples of different form and texture of dust that have been separated previously, tested and filed as a guide in analyzing subsequent samples from other sources. It came as a surprise to most people to discover the great variety of dusts that float in the air without being perceptible to the senses.

Fluid drives and hydraulic couplings of several sizes were on exhibition. Demonstrator sets, with transparent housings, showed clearly how the fluid transmitted the power to the driven unit. The many advantages of this type of link in a power drive were clearly demonstrated.

A particularly interesting feature of the inspection was a visit to the sound laboratory. Here, by means of elaborate insulation, a very low level of normal sounds was obtained, and in this quiet atmosphere tests were run on rotating equipment manufactured by the company. By means of waves picked up on a microphone, the volume of sound was recorded in decibells on a meter. The shape and motion of the sound waves was also projected onto a dark screen so that a minute study could be made of them. This was an example of looking at sound.

The highlight of this demonstration was the use of a stroboscopic device by which the rotating fan could be seen as if standing still. Every detail of the fan construction was as clearly visible as if the fan had been motionless. This permits the examination of behaviour of metal on other parts under centrifugal strain, and under actual working conditions.

There were also opportunities to see heavy fans in motion, such as those used for industrial operations or for ventilation.

The Dinner

Upon completion of the plant visit, the group joined with others at the Rackham Memorial Building for dinner. J. E. Armstrong, vice-president of the Institute, presided, and on either side he had the officers of the Detroit Section of the A.S.M.E., A. C. Pasini, R. K. Weldy, J. W. Brennan, and of the Border Cities Branch of the E.I.C., A. H. MacQuarrie, F. J. Ryder, J. G. Hoba, and their wives. General McNaughton and Mrs. McNaughton were the guests of honour. Upon the completion of dinner, the group joined others in the main auditorium for the address. Here, as an opening feature, a very impressive flag ceremony was conducted by members of the Grosse Point Legion—all of whom served under General McNaughton in the last war,—during which the Stars and Stripes and the Union Jack were placed at each side of the platform, and the Star Spangled Banner and God Save the King were sung by a special soloist. Canadian visitors were very appreciative of the warm gesture of friendship and understanding. The meeting was under the chairmanship of A. C. Pasini, chairman of the A.S.M.E. Section. After welcoming the audience he called on A. H. MacQuarrie, chairman of the Institute branch, who thanked the A.S.M.E. for their hospitality, and expressed the hope that it would not be long before the Border Cities Branch would be hosts to the Americans.

Mr. James W. Parker, a past-president of the A.S.M.E., in introducing General McNaughton, gave an outline of his career, at the same time emphasizing that here was an outstanding example of the engineer with broad vision, technical knowledge and a sense of public duty. He recalled the occasion in 1942 when the General had spoken at the annual banquet of the E.I.C. in Montreal, at which time Mr. Parker had been a guest of the Institute. The reception given General McNaughton on that occasion had given him a real appreciation of the high regard in which Canadian engineers held the General.

General McNaughton's address will appear in the November *Journal*, but no account of the meeting would be complete without reference to the question period which followed. In this, the General was particularly pleasing, giving each of the several questions serious consideration before answering. The questions were well designed to draw out additional information, many of them being pointed to the future. The answers gave great satisfaction to the audience.

Throughout his talk and the question period, one point was brought out over and over again. "We have in North America and Great Britain the finest group of young scientists in the world. Give them their heads and we will have nothing to fear from Germany or any other nation in the world." The need of giving support and encouragement to these men was of paramount importance.

The Canadian visitors to this International Meeting voted it a success. The well arranged programme, the facilities at their disposal and the hospitality of the Americans marked it as a high achievement in engineering society history. It is to be hoped that similar events may become of common occurrence on both sides of the border.

COMMITTEE ON REHABILITATION

Report On Activities For First Six Months, April to September, 1945

I—Object

The object of this report is to render to Council, and all members of The Engineering Institute of Canada, a statement of the activities of the Committee on Rehabilitation, for the first six months of active operation.

The committee was formed early this year because it was felt that many members of the Institute might require assistance in resuming peace-time occupations, and that a source of competent advice and contacts for employment would be useful to them.

II—Procedure

Appendix A at the end of this report contains the names of the members of the committee. It will be seen that a variety of background is available, and that the main industrial areas of Canada are represented.

The first step taken by the committee, in order to ascertain how best to apply the facilities of the organization to this task, was the mailing of a Rehabilitation Questionnaire to all members of the Institute in the armed forces. This was done in March, and enough replies had been received a month later to form the basis of the programme that has been followed.

The completed questionnaires fell into three main groups, viz.: (1) from members who felt that no help would be required; (2) from members who wanted assistance in locating new employment opportunities; (3) from members who were interested in returning to university with the aid available under the Post-Discharge Reestablishment Order, but who needed advice on this question.

It was therefore decided that the employment page of *The Engineering Journal* should be expanded to include a wide variety of vacancies so that (a) members would have a better idea of what to expect when they became available, and (b) they would have a means of establishing contact with the desired field. It will have been observed that this section of the *Journal* is now entitled " Rehabilitation and Employment Service " and usually comprises three full pages instead of the original one. Also each month, preprints of this section are made, and about four hundred copies are mailed to members in the armed forces about two weeks before the *Journal* is available, in order that they may have the opportunity of being first to apply for interesting openings. In this way too, many service men are reached who would probably not see the *Journal*.

A pamphlet entitled " The Engineers Return to Civil Life " was prepared to answer the many questions in connection with continued education. This attempted to present all the aspects of the Post-Discharge Reestablishment Order that were applicable to engineers, and to offer the advice of senior members of the profession on the merits of the scheme. About four hundred copies have been distributed to interested members, and the Department of Veterans Affairs, as well as the three services, have asked for and received several hundred copies for distribution to their personnel counsellors. In fact, negotiations are at present under way to allow the DVA to print this pamphlet at their expense for distribution to all service men interested in engineering.

Undoubtedly the most useful function of the committee develops as members become available for discharge from the services. It is interesting to note that most of them are making a point of coming to Headquarters at their earliest opportunity after returning to Canada from overseas, or when their service work here is nearly finished. Already nearly one hundred have been interviewed and none has gone away without several useful contacts in the line he wishes to follow.

At the request of the Royal Commission on Veterans' Qualifications, a statement of the policy and activities of the committee was presented, together with three hundred copies of all the material that had been sent to members. This resulted in a recommendation being made to the Department of Veterans Affairs, which has not yet been published. Also, the committee was asked, at the same time, to consider the claim of a group of undergraduate ex-servicemen that the monthly living allowance was inadequate. This claim was endorsed, and it is interesting to note that the allowance was increased by five dollars a week very shortly afterwards.

Among other problems that have been studied, the situation of the engineers at Petawawa came under consideration. About fifty reinforcement officers, all graduate engineers, asked the Institute to alleviate their situation either by asking to have them sent into active theatres, or allowing them their release for more useful employment. The Committee on Rehabilitation brought this matter to the attention of the proper authority in Ottawa, and the matter is being given serious attention.

III—Results

Some of the figures relating to the number of men with whom the Committee on Rehabilitation has dealt are of sufficient interest to warrant their appearance in this report.

(1) Questionnaires:

Number originally mailed		1050
Number mailed subsequently		200
Total		**1250**
Number returned completed	565	
Accounted for, indirectly	100	
		665
Remaining to be heard from		585
Total		1250

The table of analysis on page 644 is explained as follows:

Group I includes all members whose questionnaires indicated that they required no assistance.

Group II includes all members who are likely to require help, other than those in Group III. II (1) comprises those who have had permanent employment since graduation before entering the armed

Analysis	Service				Rank				Employment				Education			Rehabilitation		
Group	Navy	Army	Air Force	Overseas service	Other Ranks	Lieut. Capt.	Major Lt. Col.	Col. & above	Joined on Grad.	Ret'd. to old job	Change Wanted	Uncertain	Under grad.	Refresher	Post-Grad.	Total Answers	No. Interviewed	No. Placed
I...	21	100	50	104	4	85	66	16	7	164	—	—	5	—	2	171	17	1
II (1)...	30	65	36	74	4	85	35	7	—	—	87	44	—	—	—	131	29	7
II (2)...	43	64	14	65	6	107	5	—	59	—	38	24	—	—	—	121	27	6
III...	38	77	27	93	12	114	16	—	54	17	43	28	8	54	80	142	14	3
Total...	132	306	127	336	26	391	122	23	120	181	168	96	13	54	82	565	87	17

forces; and II (2) comprises those who graduated during war years and either went directly into the services or took temporary war positions.

Group III includes all those who have expressed an interest in continued education but who wanted advice on this question.

Of the total requiring assistance (Groups II and III), the educational background is as follows:

Chemical engineers...	13
Civil engineers...	131
Electrical engineers...	110
Mechanical engineers...	112
Metallurgy, Mining and others...	28
Total ...	394

(2) Employment Vacancies:

	No. of Companies	No. of men Required
Vacancies listed at April 1, 1945...	34	46
Vacancies received since April 1, 1945...	178	345
Total handled...	212	391
Vacancies listed at October 1, 1945...	106	255
Total closed during six months...	106	136
Placements made (confirmed) ...	48	50

Of the positions advertised in the *Journal* in the six-month period, 138 were inserted by companies for the first time and 132 of those previously advertised were republished. In other words, there have been 270 advertisements of the requirements of 138 companies.

(3) Applications for Vacancies:

An analysis of the number and kind of applications for vacancies is shown in the table at the top of page 645.

IV—Observations

The following observations are based on the tabulated figures.

(1) From the table under III (1) it is evident that to date, considerably more than half the members to whom questionnaires were sent have replied. Extracts from their letters were published in the *Journal* in August as an indication of the satisfaction expressed by most. At the present rate, it is probable that before the end of a year almost all these members will have been heard from.

It is also interesting to note the following percentages of those who have replied:

23.5 % served in the Navy
55 % served in the Army
21.5 % served in the Air Force
95 % held commissioned rank
25.5 % held field rank
60 % served overseas
70 % would like assistance of one kind or another
33 1-3% are civil engineers
28 % are electrical engineers
29½ % are mechanical engineers

(2) From the data on employment vacancies handled by the committee, it is apparent that two hundred and twelve employers have received eighteen hundred and seventy-three applications. In other words, the average is nearly nine applications per vacancy.

Approximately fifty per cent of the men interviewed have returned for a second discussion. This means that the three hundred and ninety interviews have been with two hundred and sixty individuals, of whom sixty per cent are members, forty per cent non-members. Fifty-two per cent are service men, forty-eight per cent civilians.

This analysis shows that about 32% of the efforts of the committee are being expended on "members in the armed forces", who were its original raison d'être. However, many of the non-members have expressed their intention of applying for membership, and it has not been considered advisable to restrict

Classification	Members		Non-Members		
	Armed Forces	Civilians	Armed Forces	Civilians	TOTAL
Applications to Positions adv'd. forwarded to employers	166	224	28	115	533
Record sent and men directed to employers	442	461	210	227	1340
Total..................................	608	685	238	342	1873
Men interviewed..........................	123	119	80	68	390
Known Placements..........................	16	17	11	6	50

their numbers further. Many of the vacancies listed have been of an urgent nature from employer members, and in order to render an effective service to them, and to maintain an influx of new opportunities, it is necessary to have information at hand on engineers who are available whether members or not.

The number of placements listed is probably very much less than the actual, because (a) men very frequently forget to report their successful contacts and (b) placements are very often not confirmed for a month or more after application has been made. It is to be noted that nearly half (45%) of the positions which have been removed from the list during the six months have been filled by applicants with whom contact was established through the Institute. These positions are often advertised elsewhere, and are usually listed also at the Wartime Bureau of Technical Personnel. Many of them have been cancelled due to internal changes of organization. It appears to be reasonable to assume that if all the factors were known, the efficiency of the Rehabilitation and Employment Service from the employers' point of view is about fifty per cent.

APPENDIX "A"

ADVISORY COMMITTEE ON REHABILITATION

Major-General Howard Kennedy, M.C., C.B.E., Chairman,
Vice-President, Quebec North Shore Paper Co.,
680 Sherbrooke St., West, Montreal, Que.

Captain Philip N. Gross,
Vice-President and General Manager,
Anglin-Norcross Corporation Ltd.,
892 Sherbrooke St., West, Montreal, Que.

Mr. Charles H. Jackson,
Manager, Ammunition Division,
Canadian Industries Limited,
P.O. Box 10, Montreal, Que.

Mr. Arthur H. Munsen,
Director of Industrial Relations,
Dominion Bridge Co. Ltd.,
Lachine, Que.

Major Donald C. MacCallum, Permanent Secretary,
Headquarters, 2050 Mansfield Street,
Montreal, Que.

REGIONAL REPRESENTATIVES

Border Cities Branch:
Mr. A. D. Harris,
Chief Engineer,
Ford Motor Co. of Canada Ltd.,
Windsor, Ont.

Cape Breton Branch:
Colonel J. A. Macdonald,
Electrical Superintendent,
Dominion Iron and Steel Corporation,
Sydney, N.S.

Edmonton Branch:
Mr. C. W. Carry,
Sales Engineers,
Standard Iron Works,
Edmonton, Alta.

Halifax Branch:
Mr. S. W. Gray,
Wartime Bureau of Technical Personnel,
84 Hollis Street,
Halifax, N.S.

Hamilton Branch:
Mr. Norman A. Eager,
Sales Manager,
Burlington Steel Company, Ltd.,
Hamilton, Ont.

Moncton Branch:
Mr. V. C. Blackett,
Assistant Engineer,
Canadian National Railways,
Moncton, N.B.

Niagara Peninsula Branch:
Mr. C. Climo,
Assistant Construction Engineer,
The Carborundum Company,
Niagara Falls, Ont.

Ottawa Branch:
Major N. A. Thompson,
Research Division,
Civil Service Commission,
Ottawa, Ont.

Peterborough Branch:
Mr. R. L. Dobbin,
General Manager,
Peterborough Utilities Commission,
223 Aylmer Street,
Peterborough, Ont.

Quebec Branch:
Lt.-Col. T. M. Dechène,
Assistant Engineer,
Dept. of Public Works,
Parliament Building,
Quebec, Que.

Saint John Branch:
Mr. C. C. Kirby,
213 Germain Street,
Saint John, N.B.

St. Maurice Valley Branch:
Mr. Robert Dorion,
City Manager,
Shawinigan Falls, Que.

Toronto Branch:
Lieut.-Colonel W. S. Wilson,
Assistant Dean and Secretary,
Faculty of Applied Science and Engineering,
University of Toronto,
Toronto, Ont.

Victoria Branch:
Lieut.-Colonel H. L. Sherwood,
713 Mount Joy Avenue,
Victoria, B.C.

Winnipeg Branch:
Group Captain A. J. Taunton,
Welfare Officer,
Department of Veterans Affairs.
Commercial Building,
Winnipeg, Man.

SIR JOHN KENNEDY MEDAL

J. M. R. Fairbairn, retired chief engineer of the Canadian Pacific Railway, is the 1945 recipient of the Sir John Kennedy Medal, the highest Institute award. The announcement was made at the September meeting of Council.

This medal was established in 1927 in commemoration of the great services rendered to the development of Canada, to engineering science and to the profession, by the late Sir John Kennedy, past-president of The Engineering Institute of Canada.

Himself a past-president of the Institute, Dr. Fairbairn was born at Peterborough, Ont., and graduated in civil engineering at the University of Toronto in 1893. Twenty-eight years later, his *alma mater* gave him the honorary degree of Doctor of Science.

For several years after his graduation, Dr. Fairbairn was intermittently employed on surveys with the Dominion government, in the Departments of Militia and of Railways and Canals. He also spent a couple of years in British Columbia where he did mining surveys.

His career of 38 years with the Canadian Pacific Railway Company began in 1901 when he became principal assistant to the district engineer at Montreal. His promotion was rapid, and his ability recognized by his appointment as district engineer at Ottawa, followed by assistant engineer in the chief engineer's office at Montreal, and in 1905 acting district engineer at Montreal. In 1906 and 1907, he was district engineer of the Ontario District at Toronto, being moved back to Montreal as district engineer of the Quebec District.

A year later, in 1908, Dr. Fairbairn was appointed principal assistant engineer in the chief engineer's office at Montreal, and in 1910 engineer of maintenance-of-way at Montreal. He became assistant chief engineer of eastern lines in 1911 and, in 1914, assistant chief engineer of the system.

In 1918, Dr. Fairbairn was appointed chief engineer of the Canadian Pacific Railway system, a position which he occupied continuously for over 20 years until his retirement under the pension rules of the company, on January 1st, 1939. When Dr. Fairbairn joined the

J. M. R. Fairbairn, M.E.I.C.

company, it had only about 8,500 miles of line. He played a major part in building the mileage to more than 17,000.

In 1929, he represented his company at the World Engineering Congress, and the World Power Conference in Tokio, Japan, as chairman of the Canadian delegation from The Engineering Institute of Canada.

In 1941, Dr. Fairbairn accepted the position of Director of Works and Buildings in the Naval Service of the Department of National Defence, at Ottawa, which position he resigned late in 1942.

Dr. Fairbairn is an active and valuable member of the Institute, having served as councillor, vice-president and, in 1921, as president. In recent years, he was chairman of the International Relations Committee.

He is also a member of the Institution of Civil Engineers, London, England, having served as councillor and chairman of the Canadian Advisory Board. He is an honorary member of the American Society of Civil Engineers, a member of the American Railway Engineering Association of which he was president in 1925.

Presentation of the Sir John Kennedy Medal will be made to Dr. Fairbairn at the next annual meeting of the Institute in February.

A NEW BRANCH IS BORN—AND CHRISTENED

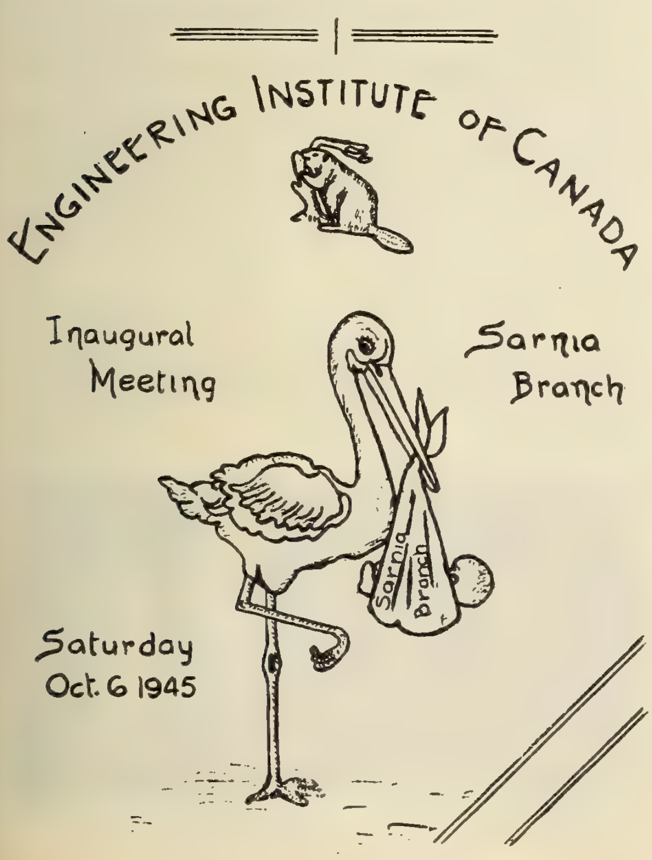
With appropriate ceremony and due recognition, the recently formed branch at Sarnia, Ontario, was welcomed into the Institute family on Saturday, October 6th. Unfortunately, due to a death in his family, Chairman G. L. Macpherson was not able to preside, but his delegate, C. F. Davison, did an excellent piece of work in his place.

The meeting took the form of a dinner at the Sarnia Golf Club, with 84 persons in attendance. At head table with the chairman were guests and representatives of Headquarters and other branches, including General A. G. L. McNaughton, J. E. Armstrong, J. B. Stirling, Paul Poitras and Huet Massue, Montreal; J. G. Hall and H. E. Brandon, Toronto; Jas. A. Vance and H. G. Stead, London; Alex Love, Hamilton; G. G. Henderson and A. H. MacQuarrie, Windsor, and the general secretary.

To open the programme, Mr. MacQuarrie, chairman of the Border Cities Branch, presented the new branch with a gavel made in Windsor of pure manganese, and suitably engraved. With it went the best wishes of the branch out of which the new branch had been formed.

General McNaughton expressed his pleasure at being present to see the beginning of a new period of expansion for the Institute. He believed the Institute occupied an unusually important place in the life of Canada, and he wished both the branch and the Institute success in the future. He referred to the world's acceptance of the war being an engineer's war, and of the necessity of the peace being an engineer's peace. He emphasized the obligation of the engineer to aid in the post-war development and post-war stabilization.

The theme back of the programme arrangement, which seemed appropriate to this occasion, was " birth ". The programme is reproduced here because it surely deserves wide distribution.



Vice-President Armstrong presented the charter and his best wishes for the success of the branch in the following words:

Mr. Chairman, Gentlemen:

I am speaking for the President and Council of The Engineering Institute of Canada.

When presenting a charter to a new branch of the Institute, it seems well to pause for a moment and look backward to see whence the engineer and the Institute have come.

Canada was at one time a vast undeveloped area. In the seventeenth and eighteenth centuries, the military engineer began to develop it by the construction of highways, canals, and structures. The civil engineer continued this development and added the railways. All other engineers played their part. Today a small portion of Canada has been partially developed and populated. Much more remains to be done than has been done.

Historically, the first engineer was the military engineer. The Armed Services now require so many different kinds of engineering that the generic term military engineer has little meaning.

The civil engineer came into being to serve civilian needs. Various specialties, such as mechanical engineering, electrical engineering, mining engineering, chemical engineering, and many others, have grown from the main trunk of civil engineering. If this development continues it may well be that some day the generic term civil engineer will have little meaning.

Programme

Golf tournament at Sarnia Golf Club
(Take 19th hole easy)

Inspection of industries
(For abstainers)

Dinner 7.00 p.m.
Grace
Toast to the King
Introduction of guests
Adjournment (For labour)
Presentation of gavel
(The child is born)

Address by Member of the Council
(Post natal instruction)

Presentation of Charter
(Certificate of Birth)

Address by Secretary
Miscellaneous advice on child welfare

Obstetricians
Gen. A.G.L. McNaughton
J.E. Armstrong
L. Austin Wright
J. B. Stirling

SARNIA BRANCH

The Engineering Institute of Canada

Incorporated 1887

Whereas the following members of The Engineering Institute of Canada namely – T. Montgomery, F. Frank Dyer, G. L. Macpherson, C. P. Warkentin, Roger Neave, M. L. Walker, J. W. MacDonald, G. W. Christie, T. W. Dill, T. K. Lewis, A. H. Munro, R. W. Dunlop, C. F. Davison, J. O. Giles, B. H. Sherwood, W. E. Taylor, Graham Wanless, S. W. Sibbald, F. A. Bain, Maurice Magnan and H. W. Ashton did make due and formal application for the establishment of a local branch of the Institute, and

Whereas authority was granted the petitioners by the Council on the ninth day of June, 1945,

Be it known therefore that the Council of The Engineering Institute of Canada, under the constitution and by-laws, hereby confirms the establishment and issues this charter to the Sarnia Branch of The Engineering Institute of Canada as evidence of the aforesaid authorization.

WITNESS OUR HAND AND SEAL
THIS SIXTH DAY OF OCTOBER, 1945

PRESIDENT

SECRETARY

Regardless of nomenclature, however, the engineer will carry on.

The first move toward the organization of an engineering society in Canada antedated Confederation. The matter was again pressed in 1880. It was not until 1886, however, that action started which culminated on June 23, 1887, in the granting of a charter to the Canadian Society of Civil Engineers. In accordance with the nomenclature of the day this name included all engineers other than military engineers.

Because of changing nomenclature, it seemed desirable, some thirty years after the granting of that charter, to modernize the name, and on April 15, 1918, it was changed to "The Engineering Institute of Canada". This name includes all engineers.

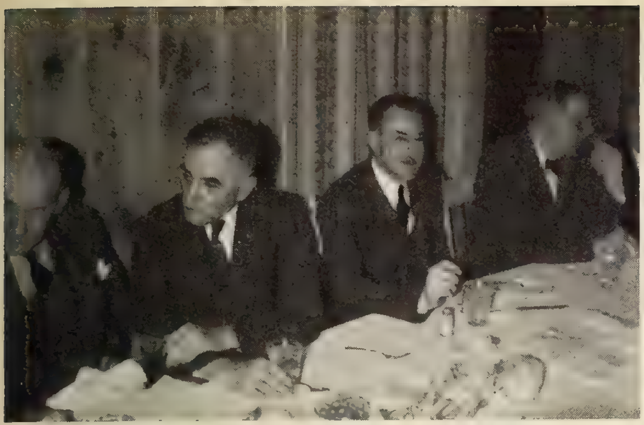
The Canadian Society of Civil Engineers was a sturdy organization. It started with about 300 members. By 1895 this number had doubled. By 1905 it had doubled again. In 1915 its membership numbered more than 3,000.

The Engineering Institute of Canada continued this growth. In 1925 its membership numbered more than 5,000. This number decreased somewhat during the depression, but by 1940 all lost ground had been recovered. At the present time the membership numbers more than 7,000.

Of this total, approximatly 4,000 are corporate members, and 3,000 are juniors and students. The growing number of juniors and students, and the increasing activities of the junior and student sections of various branches, augur well for the future of the Institute.

Left to right: H. G. Stead, John Hall, H. E. Brandon.

Left to right: C. F. Davison, J. E. Armstrong, G. G. Henderson, Alex Love.



Left to right: J. B. Stirling, General A. G. L. McNaughton, C. F. Davison, J. E. Armstrong.

Left to right: Alex Love, P. E. Poitras, A. H. MacQuarrie.

It was recognized from the beginning that an organization to serve the engineers of Canada should not be restricted to some single locality. With headquarters at Montreal it was known that branches would be required elsewhere to serve engineers locally.

The first branch was formed in Toronto in 1890. By 1910 there were five branches distributed from Quebec in the east to Vancouver in the west. By 1925 there were twenty-five branches distributed from Sydney and Halifax, Nova Scotia, to Vancouver and Victoria, British Columbia. This number of branches remained unchanged during the depression and the war.

The Sarnia Branch is the first one to be formed since 1925. It is taking the lead in what well may be a period of further expansion.

In the name of the President and Council of The Engineering Institute of Canada it is my privilege now to present to you the Charter of the Sarnia Branch.

May I be the first to congratulate the Sarnia Branch upon possession of its Charter, and to wish it a long, busy, and useful existence.

J. B. Stirling, chairman of the Committee on Professional Interests, described the work and organization of his committee, pointing out the far-reaching advantages of co-operation between like societies.

John Hall, chairman of the Membership Committee, spoke of the study which this committee had been making over the last two years, in an endeavour to find a simpler and less expensive way of admitting and transferring members. He also urged members to become active in Institute affairs as in this way they could make real contributions to the profession and secure in return unexpected dividends in the form of their own self-development.

Messrs. Henderson, Vance, Love, Brandon and Poitras, councillors from sister branches, offered the greetings from their branches and presented proposals for cooperation between them. Mr. Massue, as a past councillor, also presented his greetings and joined with others who had suggested that great opportunities for service to the profession lay in the work of the Institute.

The general secretary outlined the work of the Institute and its plans for the future. He spoke of other new branches that were in the making and of the encouragement they would receive from the experience of the members in Sarnia.

In conclusion, th chairman thanked the officers of the Institute and General McNaughton for the support they had given in this inaugural ceremony. He believed that the impetus thus given on this initial occasion would carry the branch far.

QUEBEC CORPORATION CELEBRATES 25th ANNIVERSARY

It was on February 14th 1920 that the Act establishing the Corporation of Professional Engineers of Quebec was sanctioned. To celebrate this 25th Anniversary, the Corporation is organizing a banquet to be held at the Mount Royal Hotel, Montreal, on November 24th 1945, at 7.15 p.m.

The guest speaker will be Harry E. Nold, president of the National Society of Professional Engineers, an organization which was established in the United States some ten years ago. Mr. Nold is professor of mining engineering at the Ohio State University in Columbus. The subject of his address is " The Development of a Profession ".

Tickets at $3.25 may be secured from the registrar of the Corporation at 354 St. Catherine Street East, Montreal. Dress for the dinner is optional.

ECOLE POLYTECHNIQUE'S NEW DEAN

Ignace Brouillet, M.E.I.C., a partner in the firm of Brouillet et Carmel, consulting engineers, Montreal, is the new director of the Ecole Polytechnique de Montréal, succeeding Dean Armand Circé who has retired, on account of ill-health.

Born at L'Assomption, Que., Mr. Brouillet is a product of the classical education, typical of the province of Quebec. He attended the classical college at L'Assomption and obtained his B.A. degree from the Université de Montréal in 1924. Entering Ecole Polytechnique in the same year, he graduated in 1929 with the degree of B.Sc.A. and the diploma of civil engineer.

(Photo by Albert Dumas)
Ignace Brouillet, M.E.I.C.

For about a year after graduation, Mr. Brouillet worked as assistant to the superintendent in the Sanitation Department of the City of Montreal. In 1930 he joined the firm of Baulne et Leonard, consulting engineers, Montreal, as a designer; he became chief designer in 1936 and during this period was engaged in reinforced concrete and structural steel design.

In 1940 he entered private practice in Montreal as a consulting engineer, in partnership with Guy Carmel, M.E.I.C. The firm specializes in reinforced concrete design. For the past few years Mr. Brouillet has lectured on reinforced concrete at Ecole Polytechnique.

Ecole Polytechnique is the Faculty of Applied Sciences of the Université de Montréal so that the new director also heads the Faculty.

Dean Brouillet enters his new office with the best wishes of all members of the Institute.

VETERANS SELECTION OF ENGINEERING COURSES

While it is impossible now to know exactly which division of engineering the veterans will choose, the indications are that mechanical and electrical are the immediate popular choices. This is not difficult to understand in view of the experiences they have had in the services. Most of the equipment they have encountered has been basically electrical or mechanical, or both.

More than average interest has been expressed as well in the sub-divisions of radio and aeronautics. Mechanical transport or automotive engineering too has its prospective devotees, but in Canada all these are treated as a part or sub-division of one of the basic classifications.

Fortunately it is not necessary in Canada for a student to select his final course until the end of the first and in some instances, the second year. Within this period, he may well see the merits of other branches of engineering, and thus prevent an overloading of the presently popular fields. Other divisions of engineering offer equally attractive opportunities, and the economy of the country will require that they get their share of graduates.

Not long ago the Massachusetts Institute of Technology conducted an analysis of 1,100 applications from veterans, and found very definite proof of the popularity of electrical, mechanical and aeronautical courses. Other types of engineering which may well offer better post-war opportunities were almost ignored, such as geology, mathematics, architectural, metallurgy, chemical, naval architecture and marine engineering, and engineering administration. In most instances not more than ten persons made application for any of these courses.

It is hoped that the earlier experiences in the general engineering course will develop in many students an awareness of the equal advantages of fields other than electrical and mechanical.

DIAMOND JUBILEE AROUND THE CORNER

The year 1947 will mark for the Institute the completion of 60 years of service to the profession. It is early yet to celebrate the event, but even the contemplation of it reminds one of the indebtedness of all Canadian engineers to those pioneers who foresaw the need of a professional society to bind them and their successors together, and to advance the status of the engineer.

The decision to establish a society that would embrace all phases of engineering is indicative of the wisdom and breadth of the founders. The words "civil engineers" at that time meant all engineers other than military, but with the more limited meaning that developed later it was agreed the title should be changed in order to preserve the original intent.

This has been proven a wise policy. In a country with a population the size of Canada's, it would be folly to break the profession into sectional societies such as has been done in England and the United States.

Another point upon which there has been occasional misunderstanding is the date of establishment of the Institute. The name of the Canadian Society of Civil Engineers was changed in 1918 to The Engineering Institute of Canada. This change did not in any way alter the date of the incorporation which was 1887. The corporation remained the same, and therefore the date of the foundation of the Institute is 1887.

To make this point clear the Institute's solicitor was consulted in 1943. In his letter of reply he stated:

> "The fact that the Canadian Society of Civil Engineers changed its name to The Engineering Institute of Canada does not in any way affect the date of its incorporation.
>
> "When a natural person changes his name by legal methods, the date of his birth is not affected. It remains the same. So also when a corporation changes its name, its date of incorporation is not affected."

One might also add that when a woman is married her name is changed, but that does not alter her age or birthday.

—And so, in 1947 the Institute will be 60 years old.

COLLECTIVE BARGAINING

A Report of Recent Events

The following is a report presented at the last meeting of Council by the chairman of the Committee on Employment Conditions. It will bring members up to date on the situation with regards to collective bargaining for engineers:

Your Committee on Employment Conditions submits this report in the midst of conditions entirely different from that of the past. The Committee of Fourteen has divested itself of its responsibilities and hence the Sub-Committee of Three which represented it in Governmental and other negotiations no longer exists. The Canadian Council of Professional Engineers and Scientists has by a majority vote of the Committee of Fourteen been given certain collective bargaining responsibilities with the Engineering Institute refraining from becoming a constituent member. A new organization, the Dominion Council of Federated Professional Employees, has recently been formed and as far as can be ascertained will act as a clearing house for the Provincial Federations of Employees. The Ontario Federation of Employees is reported to have a membership of about 1,000 and the Quebec Federation a membership of approximately 250. The formation of a Federation in British Columbia is reported to be under discussion. Several units have been formed in both Federations, applications for certification have been or are in the process of being applied for, but as far as can be ascertained no approval has yet been granted. No Federation or its equivalent has been set up in any of the other provinces.

With this brief preamble we proceed to the main body of the report which for purposes of simplicity and clarity is sub-divided into four sections:—

1. The Committee of Fourteen Ottawa Meeting of June 12th.
2. Reply to the Minister of Labour's letter of February 12th.
3. Invitation to attend C.C.P.E. & S. Meeting, Sept. 7th.
4. C.C.P.E. & S. Meeting of Sept. 7th.

The Ottawa Meeting of June 12th.

The Committee of Fourteen met at Ottawa on June 12th for what turned out to be the last time. At this meeting it was decided by a motion, duly presented and carried by a majority vote, that the responsibility of the Committee of Fourteen for collective bargaining be transferred to the newly created Canadian Council of Professional Engineers and Scientists.

Earlier in the meeting the Institute representatives presented a motion that the Committee of Three be enlarged to include representatives from the provincial collective bargaining federations and instructed to continue its work reporting back to the Committee of Fourteen as required. The motion was defeated, being supported by only two organizations, the Association of Professional Chemists of Quebec and the E.I.C. Four others did not vote, namely The Royal Architectural Institute of Canada, the Institute of Radio Engineers, the Professional Institute of Civil Service in Canada and the Corporation of Professional Engineers of Quebec.

The Committee of Fourteen, with its Sub-committee of Three, has accomplished much. In a period of less than one year various briefs and questionnaires on the subject of collective bargaining were issued and replies received from every part of Canada, and from men in the Armed Services from far-off lands. A policy was agreed upon, and a draft for a proposed new order was prepared and presented to the Wartime Labour Relations Board at a public hearing in Ottawa on January 9th, 1945. Within a month the Minister of Labour, The Hon. Mr. Mitchell, ruled in effect that for a period of six months professional employees could bargain under P.C. 1003 for and on their own behalf if they so desire. They cannot be outvoted by labour and included in a heterogeneous group against their wishes. A member of the Institute reports a recent case in which engineers and other employees voted as a group for certification, but the Wartime Labour Relations Board arranged for retaking the vote, with the engineers voting as a separate unit. In the opinion of your committee this established the rights for which engineers have been asking.

The Committee of Fourteen and its Sub-committee of Three has achieved all this within a few months. One may ask why such outstanding performance? The answer is: unanimity. All technical bodies went in the same direction, along the same road to the same objective. It is to be regretted that a difference in opinion concerning the formation of the Canadian Council should force a separation in the joint effort that was being made successfully by the Committee of Fourteen on behalf of the profession, especially when it was known in advance that the new organization did not represent all of the technical bodies concerned.

It was exactly with the idea of maintaining unanimity that the E.I.C. representatives presented a motion that the Committee of Three be enlarged and instructed to continue to work and report to the Committee of Fourteen; and it was with regret that they saw it defeated.

Reply to the Minister's Letter of Feb. 12th.

Notwithstanding the unfortunate premature demise of the Committee of Fourteen, your Committee wired Mr. Lea, Secretary of the Canadian Council of Professional Engineers and Scientists on July 30th inviting it to meet representatives of the Institute Committee at Ottawa, stressing the importance of presenting a united front and a common recommendation in replying to the Minister's letter of Feb. 12th before the expiry of the six months period mentioned therein. Ten a.m. August 7th at the Chateau Laurier was suggested for the meeting. This telegram was replied to by Mr. W. P. Dobson, Chairman C.C.P. E. & S., outlining the procedure adopted by the Canadian Council and stating that the augmented Committee of Three would continue its activities with respect to collective bargaining. It was also stated that the representative of the E.I.C. had been requested to continue as a member of the committee. The representative was unaware of any such request unless Mr. Dobson has reference to correspondence between Mr. MacRae and himself in which there was a wide divergence of opinion. The minutes clearly show that the Committee of Fourteen divested itself of its responsibilities, and your representative therefore considered that the Committee of Fourteen, and its Sub-committee of Three, are now without power to do anything. Mr. Dobson has what he calls an "augmented committee of three" containing four or five members, but it is not known who they represent, nor who appointed them, nor to whom they report. This becomes still more inexplicable when taken with the defeat of the motion to continue it, as previously mentioned.

Continuing the telegram, Mr. Dobson advised the C.C.P.E. & S. would meet early in September and would welcome participation of Engineering Institute in deliberations.

Your Committee replied to Mr. Dobson's wire (with copy to Mr. Lea, Secretary C.C.P.E. & S.) by night letter August 3rd advising that the Committee interprets his telegram as declining the Institute invitation to meet with its representatives and therefore changes the place of meeting to Montreal on the same date. Your committee urged that in the interest of the profession the C.C.P.E. & S. be represented as it believes it essential that the Minister's letter be replied to before expiry of the six months period and therefore finds the date suggested in his wire to be too late.

The reply on August 4th to this night letter was:—"Retel Mr. Dobson on vacation until sixteenth."

Copies of our wires with appropriate letters were mailed to all organizations having agreements with the Engineering Institute in order to keep them informed of our procedure.

The Minister's ruling by letter on February 12th stated in part:—"The board will review its recommendation after the end of the six months period." Such a statement could be interpreted to mean immediately following or very soon after the expiry date of August 12th, 1945. Prudence dictates that when dealing with an important department of the Dominion Government no situation should be permitted to develop which might prove embarrassing. Your committee, therefore, following the unsuccessful attempt to co-operate with the C.C.P.E. & S., had no alternative but to reply to the Minister's letter on August 11th requesting "that the 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."

Invitation to C.C.P.E. & S. Meeting, Sept. 7th.

Mr. Dobson wrote on the 28th August as Chairman to invite the Institute to be represented at a meeting of the C.C.P.E. & S. Committee on Collective Bargaining in Ottawa on the 7th September, at which reports would be received and consideration given to steps which should be taken to make further representations to the Minister of Labour.

At the request of your Committee, our General Secretary replied on the 6th September, saying that the Institute would be pleased to be represented at the meeting although it had already expressed itself officially for the reasons mentioned and therefore would not be in a position to make additional representations or commitments.

C.C.P.E. & S. Meeting of Sept. 7th.

Messrs. J. D. Sylvester and L. Austin Wright represented the Committee at Ottawa and they report that the business of the meeting consisted almost entirely of discussions on the wording of an amendment, which it is proposed should be made to Order-in-Council 1003, whereby the privileges given the professional worker by the Minister's ruling of February 12th would be incorporated in the order. No decision was reached but the matter was left to the Committee of Five for further consideration and with power to act. The Institute's representatives did not vote on any issue but agreed to report to the Institute Committee on Employment Conditions any recommendations that were finally agreed upon.

Your Committee recommends that the membership be informed of the general situation through *The Engineering Journal*.

R. E. Heartz,
Chairman.

Sept. 8, 1945.

ANNUAL MEETING A.S.M.E.

The American Society of Mechanical Engineers announces that the general theme of its 66th annual meeting will be "Air Power" in recognition of the part played by air power in winning the war, and also as a tribute to its Aviation Division which this year celebrates its 25th anniversary.

The Society in compliance with the request of the transportation controller, cancelled several of its previously scheduled fixtures, but now with the lifting of such bans is prepared to resume its full activities.

The meeting will take place at the Hotel Pennsylvania, New York, from November 26th to 30th. During the course of the programme, D. Robert Yarnall the newly elected president of the Society, will assume office for 1945-46. Dr. Yarnall is co-founder and president of the Yarnall-Waring Company of Philadelphia, manufacturers of power plant specialties. He is also president of the James G. Biddle Company of that city. He was recipient of the Hoover Medal in 1941.

Dr. Yarnall has long been associated with relief work of an international character. In 1920 he was head of the commission in Europe which had charge of feeding German children. In 1924 he was again sent to Germany under the auspices of the American Friends Service Committee and the General Allen Committee having charge of the liquidation of the relief programme. In June 1938, he and Mrs. Yarnall were sent by American Friends Service Committee to Austria to assist in organization of relief of refugees. In 1938 and 1939 for this Committee, he was in Berlin to protest to the German Government against atrocities. In 1941 he was a member of the commission to England to make a survey of relief needs due to war, and to consult the British Government about shipment of more food through the blockade for the aid of children and mothers in France.

"MULBERRY" IN MONTREAL

This now famous exhibit opened in Montreal on October 2nd, upon which occasion Colonel the Honourable Mr. Ralston performed the ceremony. His address is reproduced at the conclusion of this report, and well deserves to be read by everyone.

The Montreal Branch had a private showing on the night of October 11th, to which they invited the members of the Military Engineers Association. Ladies also were present. There was an attendance of 1,200. J. B. Stirling, chairman of the branch opened the proceedings with a welcome to members of other organizations, and an appreciation of the engineers responsible for the Mulberry project.

" Mulberry " continues to be a success. Daily attendance in Montreal has reached as high as 10,000, and it is estimated that over 100,000 people will have seen the model before it leaves the city.

Arrangements have been completed for a showing in Windsor from December 12th to December 18th, and in Hamilton from January 7th to January 12th. From there it goes to Winnipeg where it will be open from January 29th to February 12th. The balance of the itinerary so far arranged is:

	Date of Opening	*Closing Date*
Regina	March 1st	March 7th
Calgary	March 25th	March 30th
Edmonton	April 15th	April 20th
Vancouver	May 6th	May 18th
Victoria	June 3rd	June 8th

War Office party pose in front of Mulberry chart. Left to right: Lieut.-Col. C. W. Glover, officer in charge of the Mulberry Exhibition; Mrs. M. C. Lancaster, personal assistant to Col. V. C. Steer-Webster, O.B.E.; Col. V. C. Steer-Webster, O.B.E., chief of the Mulberry mission to Canada; Staff Capt. F. H. Greatrex, second in charge of the Mulberry Exhibition.

Address by The Hon. Colonel J. L. Ralston

For half a year and more the world awaited with dread and hope for the assault across the channel. Its coming was no secret—the secret was *when* and above all *where?*

Military commentators and columnists, week after week, catalogued every port, from Lorient to Le Havre, and weighed the advantages and disadvantages of each. Arm chair critics, as well as the German General, took their turns at making an " informed guess " as they call it, at what port the blow would be delivered.

It seemed obvious that a well equipped port must be used. It was not enough simply to land a sizeable force to get a toe-hold on the Continent. Facilities had to be available to land rapidly the food and equipment necessary for continuous battle, and the troops and arms and supplies required, to fan out and deepen the bridgehead, and drive forward.

Left to right: Henry Morgan, Col. R. L. Ralston, Col. V. C. Steer-Webster, O.B.E.

And then there was the unpredictable channel weather. That seemed to demand a deep water harbour, protected from the weather, and commodious and well equipped.

But Dieppe—that hard, savage clash—that epic of shining courage—that costly operation—had taught many lessons which had already been put to good use in the landing on North Africa and at Salerno.

One lesson was, that the Germans had concentrated their heaviest defences at all the major ports on the coastline of Northwest Europe, and that a frontal attack at any of these places was likely to be disastrous. All that was known to those who had to plan for the invasion.

The alternative, of attacking the less heavily defended beaches, was equally precarious, because even if the assault troops did get in, there was no guarantee of weather to permit further landings of troops and equipment in time to back up those who were holding on—much less to land quickly the millions of men and hundreds of thousands of tons of equipment for the build-up and break-through, before the enemy could rush up his reserves. The alternative was audacious—to assault the beaches where the defences were weaker, and take our harbours along with us.

Today you have before you the models from which those harbours were built. The building was done in Britain by about 300 British contractors, 100,000 British workers. They were organized in ports, harbours and shipyards all over England, and they finished the job in seven months.

The component parts were towed in sections to the South Coast of England—from there 100 miles across the channel where they were put in place—an outside breakwater over two miles long, protecting a pierhead a mile long, parallel with the beaches—over a mile and a half of floating causeways connecting the pierhead with the beaches.

I remember the amazing reports coming in, day after day, of the landings—they seemed incredible. They had planned to land not less than 40,000 men a day, and by D-Day plus 10, 500,000 men and 77,000 vehicles had come ashore, in spite of the worst storm in forty years on the 19th-21st of June.

The millionth man was landed D-Day plus 30—just one month after the Canadian Third Division, in the forward assault line, stormed up the beaches.

Mulberry was a British invention—British designed—built with British material by British labour. All three Services were in this epoch-making undertaking.

The harbour was planned by the Admiralty, and the War Office—it was towed over by the Royal Navy—it was protected by the Royal Air Force—it was constructed in place jointly by the Army and Navy. All shipping was controlled by the Navy, and the Mulberry port was operated by the Army.

For Canada the visit of Mulberry recalls two great stories of Canadian fighting men. Mulberry had its origins in Dieppe—without Dieppe Mulberry might never have been thought of. The men of Canada who that day fought that bloody battle, unmasked the enemy's strength and taught the world that something more than numbers, and more than courage and dauntless heroism, was needed to storm and capture Europe's ports. And that lesson, and their selfless sacrifice, was not in vain.

But that day the gallantry of those intrepid fighters against heavy odds paved the way for their comrades of the Third Canadian Division, on D-Day, to strike the Hun the crashing blow which was the beginning of the end, one year later.

The story of Canada's part in that year of fierce but victorious fighting is a sombre but glorious page in the history of our Dominion.

God help us to be mindful always that it is because of men and women such as they, on Sea, and Land, and in the Air, that Peace has come.

Mulberry to Canada is a symbol of Canadian sacrifice at Dieppe, and a pathway to Canada's telling participation in the battles through to Victory!

COLUMN RESEARCH

In March of this year the Institute was invited by the American Society of Civil Engineers to participate in a proposal to establish a Column Research Council under the Engineering Foundation. Shortridge Hardesty was chairman of the organizing committee. The Institute gladly accepted the invitation, and has appointed as its representatives, P. L. Pratley, consulting engineer, and R. S. Eadie, chief engineer of the Dominion Bridge Company, both of Montreal, and J. N. Finlayson, dean of engineering at the University of British Columbia.

In the original communication to the Institute, the committee outlined the present situation, and its hopes that some improvement could be realized. From that letter we quote:

> "The field of designing and detailing compression members in engineering structures is a confused one, and is becoming more so as new materials are produced or proposed for structural use. It is well known that different specification-writing bodies prescribe different column formulas to meet the same condition, and that others prescribe the same formula to cover quite different conditions.
>
> It is not as generally understood as it should be that:
>
> 1. There is no possibility of applying a single column formula to all kinds and uses of columns, unless it contains several other factors besides length-ration, and thus becomes most unwelcome in its complexity.
> 2. From this can be generated, in any given field of application, groups of design rules, similar in form but differing in numerical constants, each valid in its limited field but not in other fields, each as reasonable and logical as any other; the whole comprising a unified, national and generally accepted approach to column design, replacing the present unnecessarily individualistic situation.
>
> It would appear that an attempt at such a national approach and national re-education in the field of metallic compression members is warranted, and that the first step is to invite the participation of all specification-writing and specification-using entities. The objective is that, when the necessary programme of study and research has been developed, adopted, and executed, the resulting recommendations shall have the acceptance, support, and use of the greatest possible number of designers.

Among the organizations participating in this research are the following:

Engineering Foundation.
American Society of Civil Engineers.
(Association of American Railroads.
(American Railway Engineering Association.
The American Society of Mechanical Engineers.
American Institute of Consulting Engineers.
The Engineering Institute of Canada.
American Institute of Steel Construction.
Public Roads Administration, Washington, D.C.
American Association of State Highway Officials.
National Bureau of Standards.
U.S. Corps of Engineers.
Bureau of Yards and Docks, U.S. Navy.
Bureau of Ships, U.S. Navy.
U.S. Coast Guard.
Society of Naval Architects and Marine Engineers.
National Advisory Committee for Aeronautics.
American Standards Association.
American Institute of Architects.
American Institute of Electrical Engineers.
Pacific Coast Building Officials Conference.
Structural Engineers Association of California.
American Iron and Steel Institute.
Aluminum Company of America.
Steel Plate Fabricators Association.
Institute of the Aeronautical Sciences.

So far the work has been largely of an organizational nature, but it is hoped that before long there will be material of a technical nature to publish in the *Journal* so that members may be kept informed.

THE SCANDAL OF GOVERNMENT ENGINEERS' SALARIES

The following letters recently received at Headquarters expose the degrading situation in which engineers, who return home after having served their country on the battlefields, find themselves when they seek to continue their service to their country in the Government employ. Comment would be superfluous. For obvious reasons, the signatures have been deleted.

A Civil Servant Speaks for the Veterans

September 6th, 1945.

The General Secretary,
The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal.

Dear Sir:

I read with a deep personal interest the exposition, under the heading " Engineers—A Dime a Dozen " in the August issue of the *Journal*.

All this article says is only too true. I have behind me a record of over 30 years' service with the Public Works Department of the Dominion, and a few years ago attained the position of District Engineer. The salary for this position is \$310.00-\$385.00 per month. It is unnecessary to go into the qualifications demanded for this position nor the responsibilities which this position carries.

Demobilization of the Armed Services is speeding up and immediate rehabilitation is urgent. This war has seen the promotion of young men to high rank. A Wing Commander came in to see me seeking employment. All I could hold out to him would be a position of assistant engineer at a starting salary of \$2,220.00, rising to a maximum of \$2,700. Naturally this will not be the place he will seek his future work. The Civil Service will get the engineers that no one else will employ.

The subject of adequate salaries for Government engineers has long been discussed with very little success. Reasons for this are many. There is no one person to whom to present requests for proper recognition. It is believed by the public—those who do have dealings with the Government engineer, that he is well paid for his work, not knowing or troubling to find out what he is being paid. Innumerable presentations have been made to the " Government " to have salary revision made; investigation is promised while the presentation is placed on the file where it remains —forgotten.

The Civil Service was re-organized in 1921 on recommendations of Young & Company of Chicago and Toronto. Since then, technical employees' salaries have been investigated and recommendations made by the Beatty Commission in 1929. Prior to this, your Institute had presented a revision of salaries as a " desirable scale ". The " Coon Committee " made recommendations at a later date which, for some reason, have been kept secret. Then your own " McRostie Committee " recently made presentations, which were reported in the *Journal*. No action by the Government has been taken on any of those.

It is useless for such a large and powerful body as the Institute to " suggest a desirable scale ". The only way to obtain what the Institute has claimed it desires is to demand it and until this is presented as a demand backed by all the power of its membership, the time, study, ink and paper might as well be saved, as no results will be forthcoming.

Drastic action will have to be taken by the Institute on this matter if results are to be obtained. Your members look to you, naturally, for the assistance they so much need. Only such an organization as this can place demands that will guarantee action.

Yours very truly,

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

A Veteran Speaks for Himself

September 11th, 1945.

The General Secretary,
The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal.

Dear Sir:

It is with a fair knowledge of the efforts that have been made by the Engineering Institute, the Professional Institute of the Civil Service of Canada and some of the interested Departments of the Federal Government, that I am sending you this letter of protest against the inadequate scale of salaries for engineers of the Civil Service. My case is only one in a hundred perhaps and probably no more interesting or deserving than any other, but it is only in stating it that I can contribute to the bettering of the shocking situation in which I find myself after five years' service overseas out of five years and nine months in the Army.

Let me say, before telling my story, that I do not intend to add one suggestion to the already voluminous and well-founded reports on the inadequacy of the present scale of Government Engineers' salaries, nor to the fully justified recommendations that were put forward to bring it to a level which could bring to the beneficiaries a fair chance to make both ends meet, let alone the self-respect and the self-confidence that the practice of this profession should inspire.

When I enlisted in September '39, I had been working five years as a Government engineer on a temporary basis, and I was drawing then more money than I get now, that is to say more money on the same scale of salary, as income taxes were far below what they are now. Due to the uncertainty of the post-war outlook at the time, I applied for and obtained an appointment on a permanent basis, at a lower salary, and left this country as an officer in the Army, but with the prospect of receiving about the same pay as a sergeant in my unit after retirement from the service.

During the war, I was promoted once in my civilian status and thereafter chose to forget about post-war pay as the job in hand needed all my attention and energy. On retirement, my pay as a major,—and there are plenty of majors in the Army,—was \$363.00 a month, married with two children. Without income tax, this would have been fair and perhaps a little higher under present conditions than the average income of engineers with the qualifications and experience comparable to what I can claim for myself. Instead, I found out that the only recognition of the changed conditions that the Government, Civil Service Commission or Treasury Board, whoever it may be, found necessary to grant, was a beastly increase of \$6.51 a month to an already inadequate salary of \$2,700.00 per annum. After deduction of contribution to pension and taxes, the net amount left is \$192.00 a month! No need to tell you that with this generous pay, I still have to "route march" on the streets of this town, after five years of it overseas, whenever I have business or personal errands to make, in order to save the street-car fare which my very tight budget will not allow me to spare.

I pondered over it for a while, but now I am convinced (my training in mathematics includes simple arithmetic) that I will have to use some of my gratuity money to make both ends meet as long as this situation lasts, and it may last a long time if I can judge by some of the examples under my eyes in the office. Just the same, I had pretty good plans for investing this money in a home.

The Government of this country invested at least $5,000 in training me for four years at Royal Military College to become a potential officer for the Army as one object, and an engineer or a useful citizen as another. The first of these two objects I have now fulfilled to the best of my ability, and I am ready to devote the rest of my life serving this country in order to attain the other one, if I am only given a fair chance to "live" up to it.

As you can see, my case is quite simple and not out of the ordinary. I am not asking for promotion nor special favor,—just asking for fair wages, like steam shovel operators, stationary "engineers" and other lower trades are getting, as you are probably fully aware.

There are most likely several others like me who are members of the Institute and who have the unfortunate fate of being tied up to the Civil Service Commission scale of salaries. I wish specially all those of us who have been overseas could be canvassed and asked to express their grievances or more rightly to state their cases. I am quite sure that all of them would prove as disturbing as mine and probably more so both to the writer and to the profession which finds itself holding the keys to modern progress, modern war, and probably lasting peace, and at the same time getting less remuneration for all it produces than the strong-arm men that it hires to execute its brain-work.

Yours truly,

............., Jr. E.I.C.

WARTIME BUREAU OF TECHNICAL PERSONNEL

Monthly Bulletin

Reference has been made in previous reports to the fact that the cessation of hostilities in Europe has been followed by a shift of emphasis in the Bureau's activities, rather than by any curtailment of operations. This has become even more evident with the ending of the war against Japan, which naturally resulted in further drastic revisions of the war programme. As long as the country's war production was building up to its peak, and subsequently being held at a high level, the Bureau was able to report continuous shortages of manpower in practically every branch of science and engineering, and the task in the technical personnel field, just as in other spheres of manpower allocation, was to find men for jobs. It has been anticipated for some time, however, that the complete cessation of hostilities would call for greater stress on the reverse procedure; namely, finding jobs for men.

In the case of those who were expected to be demobilized from the Armed Forces, the necessary search has been under way for some months to record openings which would be available for the absorption of such persons into civil employment. It has thus been possible to offer to such persons a comprehensive picture of the type of openings that are available, as well as considerable information as to prospective activity in those fields of work which normally absorb technical persons.

Second only in importance to the matter of dealing with service personnel is the question of assisting in the resettlement of those technical persons who have been engaged in types of war production which, with the cessation of hostilities, have now been subjected to drastic curtailment or to complete shutdown. Here again every effort has been made to record in advance the possibilities of new employment, and the Bureau's officers in the field have been constantly canvassing the situation to make sure that all possible information is available for those who have to seek new employment.

While it is true that the absorptive capacity for technical persons in industry may not be quite so obvious as it was in wartime, simply because the problem is one of less urgency, there is every indication that openings are now being filled at a greater rate than has applied at any previous period since the Bureau was set up. In terms of permits issued for new employment of technical persons for the five-month period April to August inclusive (this includes the absorption of the greater part of each year's graduating class), the figures are as follows:

1942	1,680
1943	2,574
1944	2,706
1945	2,986

These figures will be studied month by month to see if there is any reversal of the present trend, and in the meantime additional opportunities for employment will be constantly canvassed.

Personnel Changes

There have been several changes in the staff of the Bureau since the start of the year. Besides the departure of Mr. H. W. Lea, who is now Co-ordinator of Public Projects for the Department of Reconstruction, Mr. W. L. Cassels has returned to his own firm, Mr. C. J. G. Carroll has transferred to architectural work with the National Research Council and Mr. C. P. Meredith has retired. As one replacement, Mr. J. A. Warburton has been engaged. He is serving as a Personnel Officer and carrying on some of the duties of those he succeeds. Mr. Warburton, a graduate in Mining Engineering from McGill, served in the Royal Canadian Engineers during the full period of the First World War, practised mining engineering in Canada and abroad, worked on labour management problems in industry, and during the last war again served with R.C.E., retiring with the rank of Lieutenant-Colonel. Mr. H. S. Kennedy, engaged some months ago to supervise the special survey of technical personnel, is taking on in addition the duties of Office Manager, and at the same time giving attention to the rounding out of registration of technical persons and bringing Bureau records up to date.

INTERNATIONAL CO-OPERATION

Ottawa Conference on Unification of Engineering Standards

The recently concluded Conference on Unification of Engineering Standards held under the auspices of the Combined Production and Resources Board (C.P.R.B.) was a unique event for Canada. Similar conferences of the same groups were held in New York in 1943 and last year in London. The Canadian Government was host to the entire conference, and throughout was represented by the Hon. C. D. Howe, Hon. M.E.I.C., Minister of Munitions and Supply and Minister of Reconstruction. International meetings are always of more than usual significance, but this one exceeds the usual expectations. It dealt with a subject so far reaching that its importance is beyond the estimate of a person who has not made a close study of it.

The Engineering Institute of Canada had more than a casual interest in the conference, not only because of the engineering nature of the subjects being discussed, but because along with the American Society of Mechanical Engineers, it was host to the group for dinner on the night of September 28th.

The conference opened on September 24th and closed October 6th. All meetings were held in the Chateau Laurier, Ottawa. Fifteen delegates came here from Great Britain, and over a hundred from the United States. Canadian representation totalled about twenty. Additional delegates from Washington joined the British group in Ottawa.

The programme was a stiff one, calling for technical sessions every morning and afternoon, and sub-committee meetings almost every evening. The main subject, screw threads, was broken down into numerous sub-sections of threads, such as acme, stub acme, buttress, high duty studs, instrument, pipe, fine motion, and miscellaneous. Other phases closely related to screw threads were also dealt with such as limits and fits, drawing practice and metrology.

The fundamental differences btween British and American screw thread forms were resolved to the point where the delegates were prepared to return to their respective countries with a specification for a basic thread form that would provide a unified standard for all countries employing the "inch" system. This basic form retains the best features of the present forms and at the same time a series of associated diameters and pitches have been worked out which it is believed will simplify existing practice and yet provide an adequate range of choice for all general requirements. The proposal on a basic thread form was by far the most outstanding accomplishment of the Conference and exemplifies the spirit of collaboration that prevails among the engineering professions of the three countries.

Hardly less noteworthy is the agreement reached at the conference on acme and stub-acme threads. It is this type of thread that is extensively used on aircraft, machine tools and other mechanical devices where a traverse motion is required. While these specifications will be submitted to industry in the three countries through the national standards bodies, representatives of the three countries attending the Conference feel certain that what they term an A-B-C Standard will be speedily approved.

The delegates reached a mutual understanding on specifications for small screws such as are used in watches and clocks. An understanding also was reached on threads for microscope lenses, and it was decided that steps should be immediately taken to write unified standards for all threaded parts for cameras, including the screw thread for mounting on tripods. Agreement was reached on a specification for fine motion screw threads, such as are employed in micrometers.

In what might be termed special thread forms, engineers from the three countries reached an understanding on certain specification aspects of the buttress thread form. It is this type of thread which is used extensively on aeroplane propeller hubs and in other applications where stresses are in one direction only. Considerable progress was made in the assembling of engineering data on high duty studs in light alloys but the diversity of practices, particularly between Great Britain and the United States, made it impossible to formulate definite recommendations for a unified practice. It was the consensus of the engineers present that a great deal of exploratory work was required in this field.

The discussions on drawing practice held during the Conference were what was termed "exploratory" in character. Considerable data were exchanged between engineers of the three countries and it was unanimously recommended that the subject should be pursued actively with a view toward unification of practice.

The meeting held on pipe threads, while not conclusive in its findings, resulted in an invitation to British and Canadian representatives to continue discussions at the convention of the American Petroleum Institute in November.

In somewhat the same category was the subject of limits and fits in engineering. While this subject has been studied in the three countries over a period of the last two years, only partial agreement was obtained due to the highly technical aspects of the problem coupled with the rather diversified practice to which each country is committed. It was decided, however, that further discussions toward reaching a more complete agreement were desirable and a meeting on this subject has been scheduled to take place in New York prior to the return of the British delegation.

Practices in precision measurement and gaging methods were included as a separate item on the agenda for the first time. Outlines of progress made in precision measurement were presented at the sessions held on this subject and suggestions were made which, it is hoped, will ultimately lead to the coordination of practices in the three countries. Data were also offered which outline proposed specifications for screw threads and connection details for gas cylinders.

The British delegation, numbering fifteen, plan to visit various industrial centres in Canada and the United States and are expected to leave for England sometime during the latter part of this month.

The British group was headed by Stanley J. Harley, Technical Controller, Machine Tools Control, Ministry of Supply. The Americans were headed by Elmer J. Bryant, Director of Research, Greenfield Tap & Die Corpn., while the Canadian delegates were headed by James G. Morrow, the Steel Company of Canada, and chairman of the Canadian Standards Association.

In spite of the demands of the technical programme, a few social events were squeezed in. At the opening luncheon, on Monday, September 24th, there were short addresses, which took the form of a welcome to Canada from the Hon. C. D. Howe, and replies on behalf of the United Kingdom and United States delegations.

On Thursday afternoon, the 27th, there was a general session at which Mr. Howe presided. On the platform with him were the other members of the Combined Production and Resources Board or their deputies. The Board is made up of one representative from each country, as follows, W. L. Batt, Hon. m.e.i.c., the United States, Sir Henry Self, United Kingdom, and C. D. Howe for Canada. Unfortunately, Sir Henry Self was unable to be present but his deputy, H. G. Vincent, ably represented him. All three gentlemen spoke upon this occasion. Abridgements of the addresses made by Mr. Batt and Mr Vincent are reproduced at the conclusion of this account.

Co-chairman Dr. R. M. Gates, past-president of A.S.M.E.

Co-chairman Dr. C. J. Mackenzie, past-president of E.I.C.

On Thursday evening the entire group were guests of Mr. Howe for dinner at the Country Club, over which he presided. He presented to the guests Sir William Stanier, and the American Ambassador, Mr. Ray Atherton, both of whom spoke most interestingly.

On Friday evening, the 28th, the Engineering Institute joined with the American Society of Mechanical Engineers to entertain the three groups at dinner at the Rideau Club, under the co-chairmanship of Dr. Robert M. Gates, past president of A.S.M.E., and Dr. C. J. Mackenzie, past president of E.I.C.

In opening the meeting, Dr. Mackenzie explained that these two societies had wished to show their interest in the deliberations of the conference, and although both were well represented by members on the various technical panels, they desired to give further support and encouragement to the important work in hand.

In his own inimitable manner, Dr. Mackenzie introduced the head table guests. It is impossible to catch and reproduce on paper the scintillating style with which this was done, but here is the list of guests: Mr. Ray Atherton, American Ambassador; Sir William Stanier, Special Adviser to the Ministry of Production, and chairman of the Mechanical Industries Committee of the British Standards Institute; the Hon. C. D. Howe; W. L. Batt, vice-chairman, War Production Board, U.S. representative on C.P.R.B., and on Combined Raw Materials Board, and president of S.K.F. Co.; S. J. Harley, chief of the United Kingdom delegation; Major-General Glen Edgerton, U. S. War Department; H. G. Vincent, deputy representative for U.K. on C.P.R.B.; James Morrow heading the Canadian delegation; Rear-Admiral A. M. Charlton, chief production branch, Office of Assistant Secretary, U.S. Navy; Dr. Chas. Camsell, Deputy Minister of Mines and Resources and a past president of E.I.C., Major-General A. E. Macrae, British Military Technical Adviser to Dept. of Munitions & Supply; E. J. Bryant, head of U.S. delegation; and W. R. McCaffrey, secretary, Canadian Standards Association.

The outstanding feature of the evening was the presentation to Sir William Stanier of a certificate of Honorary Membership in the American Society of Mechanical Engineers. Mr. Howe, with an appropriate biographical sketch, presented Sir William to Mr. Gates, who made the presentation. The biography is as follows:

"During his entire career, Sir William Stanier has been connected with the mechanical Engineering of railways. From 1892 until 1931 he was with the Great Western Railway, rising to the position of Assistant Chief Mechanical Engineer. While Works Manager at the Swindon plant he designed and built the locomotive 'King George V', and brought it to the United States for the Centenary of the Balti-

Head table, left to right: W. L. Batt, Ray Atherton, Dr. C. J. Mackenzie, Dr. R. M. Gates, Sir Wm. Stanier.

Left to right: Dr. C. J. Mackenzie, Dr. R. M. Gates, Sir Wm. Stanier, Hon. C. D. Howe.

more and Ohio Railroad.

"In 1931 he was appointed Chief Mechanical Engineer of the London, Midland & Scottish Railway, regarded as the highest railway mechanical position in Great Britain. In this position he has been responsible for many noteworthy developments in the construction and design of locomotives. The famous locomotives associated with his name include the 'Princess Royal', a turbine locomotive, the 'Coronation Scot', exhibited at the New York World's Fair in 1938, and the 2-8-0 freight tender locomotive, the Standard British War Design for heavy freight traffic and widely used in overseas war service.

"During the war he was loaned by the L.M.S. to the Ministry of Production as a scientific adviser, his title being Director of Scientific Research.

"Sir William has rendered outstanding service to his country on several important government commissions, including the Indian Railway Engineering Commission in 1936, and the Indian 'Pacific' Locomotive Engineering Commission of 1938.

"He served two terms as President of the Institution of Locomotive Engineers and was President of the Institution of Mechanical Engineers. This latter body conferred Honorary Membership upon him.

"In 1942 he was knighted for outstanding services in connection with railway engineering and in 1944 was elected a Fellow of the Royal Society, a distinction held by only one other locomotive designer, Robert Stephenson."

Mr. Batt was the speaker of the evening and gave the audience something to think about. He cited specific instances of mutual aid between Canada and the United States which have never been reported publicly. He emphasized the importance of this wholly cooperative spirit, and assured his listeners that he could not recall a single instance where the members of the combined groups on the Production and Resources Board, and the Raw Materials Board had ever been influenced in their decisions by any other factor than their common interest in the common cause. He told of Canada sending to the United States equipment which was in very short supply and which was vital to Canada's own protection, because the U.S. need was considered greater. He hoped that some day the history of these combined efforts would be written, so that citizens of each country would know something of what had been done by the other.

The Leaders Speak

Mr. Batt Appeals for Prompt Action

In Mr. Batt's address at the open meeting on Thursday, he appealed to the three countries to capitalize immediately upon the advances which, because of the war urgency, had been made already in standardization. He believed that an effective blow for peace would thereby be struck.

Mr. Batt made special reference to the successful engineering of new screw thread standards during the war. He outlined how differences such as simple and rudimentary parts of machines had cost the United States, in the early stages of the war, at least $100,000,000.

"This was a minimum estimate," Mr. Batt said, "the actual sum may have been many times that."

Reviewing the long history of the differences in screw threads over the past century of accelerated industrialization he said:

"In 1841 Sir Joseph Whitworth offered the first standard form in a series of pictures of screw threads. During the next few decades the Whitworth system was generally adopted in Great Britain and hence, because of the preponderance of British machinery manufactured, in most of Europe, including Russia.

"It was widely used in the United States, too, but in 1864 William Sellers presented a paper at the Franklin Institute in Philadelphia, taking exception to the Whitworth thread and introducing some ideas of his own.

"To greatly oversimplify this," Mr. Batt continued, "one might say that the Whitworth thread gave a hill and dale appearance—a rounded root and a rounded crest. Sellers proposed that this could be simplified and two cutting tools used instead of three, simply by making the roots and crest truncated or angular. Over a period of years these differences have created many difficulties for manufacturers of machines in the export market, and in the First World War there were many unfortunate mix-ups.

"But the man on the street probably has known little of this unless he happened to have an English automobile that required a repair in an out-of-the-way locality. It would have been perfectly possible for him to have been delayed several weeks cabling to England for a ten cent screw. And that individual would henceforth undoubtedly have been an enthusiast for international standardization.

" When World War II confronted us so sadly, the screw thread situation became extremely serious, not only because of the money involved but, more important because of the time element.

" Our first inklings of the trouble came even before the war when the French and the British came over here to place contracts and required equipment produced to Whitworth and other screw standards. Our American manufacturers found they required new taps, dies and gauges when they produced these goods. One of the most difficult American problems involved the rounded top of the screw threads, because the requisite tools were very difficult to obtain.

" When we got into the lend-lease phase of the war and the orders mounted from millions into billions, our problem was obviously multiplied. And when the United States entered the fighting phase, we found such ridiculous situations as having to have identical supply depots in the Middle East, one stocked with parts for Whitworth repairs and one for American Standard.

" We were making such things as machine guns and anti-aircraft guns that were identical in appearance if laid on a table or viewed in a field, but in which the parts were not interchangeable simply because of the little screw threads that hold them together.

" This is a machine age, and machines are held together with screws, so the ramifications of this are as wide as your imagination.

"Army engineers met this problem with resourcefulness and ingenuity by evolving a form of truncated Whitworth thread, which is to say, one having a rounded root with a flat top.

" Under the sponsorship of the Combined Production and Resources Board, the American Standards Association invited a mission to come from Britain to explore values of cooperation. The meetings were held in New York. Last fall a joint United States-Canadian mission visited London.

" This may sound like a great deal of goings and comings but you, of course, appreciate that my description of the differences in screw threads has been immensely oversimplified There has been the problem of cylindrical fits; the problem of drafting practices—and here let me tell you a little story:

" Early in the war the British gave us license to produce the engine used in their wonderful Spitfire fighter. It was the Merlin engine made by the Rolls Royce people.

" The Packard Motor Company undertook the assignment. The plans were put aboard one of Britain's finest and newest battleships and rushed to this side of the water.

" Thus the plans got to Detroit, and despite the fact that the Rolls-Royce tolerances were much more flexible than ours, calling for a great deal of handwork, and despite the fact that their drafting plans were drawn from one angle of projection while ours are drawn from another, it is a fact that the Packard people transcribed the drawings, standardized the mechanized production, built a plant, and got Merlin engines rolling out in the space of ten months.

" Well, to get back to these global perambulations, there is the question of high duty studs, pipe threads, screw threads for compressed gas cylinder outlets. You can imagine what this meant when American-made cylinders containing compressed gases such as acetylene and oxygen went overseas during the war. Then there were acme threads and buttress threads and instrument threads—all these presented many individual problems that required careful considering, but under the pressures of war and our great desire within the Combined Boards to accomplish as much as we could towards simplification and unification, this work has now progressed to the point where I feel justified in urging, in the strongest possible terms, their general adoption in all countries.

" Now that the fighting phase of the war has ceased, no doubt some of the pressure for these improvements will vanish. Yet it is clear that if standards in manufacture are of value to all manufacturers within a nation, they are no less valuable—nay, essential—to manufacturers engaged in world commerce.

" I happen to be one of those firmly convinced that economic frictions underlie most of our wars. I am among those who believe that the way to eliminate economic frictions is to facilitate trade, and it is clear to me that different standards of screw threads will always be an obstruction to easier trade. Therefore, I ask all of you to approach this question with something of the spirit of a zealot.

" Engineers must see the unification of standards through to a final conclusion. The governments of our countries must, and I will assure you this is important, assist through whole-hearted encouragement in the work of this project. All of us have recognized how vital it has been to combined war production. Let us now have uniform standards and thereby strike a blow for peace."

Mr. Vincent Speaks of Goodwill and Good Purpose

Following Mr. Batt, Mr. H. G. Vincent, deputy to Sir Henry Self, the United Kingdom representative on the Board, had this to say:

" These conferences, on the unification of engineering standards, show one characteristic of the working of the Combined Production and Resources Board. It was concerned with the " production lines " of the three countries, and offered at all times a table for the frank discussion of difficulties and the search for improvement. In the early days it was apparent that differences of practice in the engineering industries on either side of the Atlantic were holding up projects for the use of industrial facilities in combination. What was wrong, in the face of urgent war needs, was not the practices but the fact that they were different. The clearest example was the screw thread. Confronted with vistas of wasted facilities, delays and increased cost, the C.P.R.B. invited to its table the best technical skill of the industries of its member countries.

" As I understand, the primary purpose of my country's first mission to the United States, in the fall of 1943, was to assist in resolving difficulties which had arisen in the production in America of Whitworth threads for munitions of British design for British Forces. There were many types of munitions, according to the needs of modern warfare, with specifications including the Whitworth thread, and we required more and more of them for we were hard pressed, and incidentally our own industrial centres had from time to time their visitations from the German Luftwaffe. Achievement was recorded in agreed modifications of the normal Whitworth threads, which were worked out and published as war-time standards.

" But once started, the scope of the work extended. The situation, with its diversities and variations of practice, was the outcome of many years of engineering development by different minds under different conditions. Time had brought many ramifications. So the Conference has taken up other forms of screw threads than the normal Whitworth, together with applications for special projects. It is considering the practice of the drafting room in the preparation of working drawings. It is examining the possibility of obtaining a thread form and series which can be adopted as general engineering practice in all countries using the inch unit in measurement. In current meetings agreement is being reached on acme and buttress threads.

"The work is notable for its future prospects. So much that has been done in C.P.R.B. has been transient, a diversion of resources to war and expedients for war purposes. Most of that has served its purpose. But there is something which should be more lasting. The groups of experts which have been formed under the stress of war will no doubt continue in being. The programmes of research will be carried on, with the object of getting optimum values of the relative strengths of threads of different forms. These are systematic practical tests, for the matter is not solely one of compromise or adopting the mean, but of establishing the best thread, sound in performance and simple in manufacture. The strength of the United Nations will be less than it should be, less ready for emergencies, if this work is not pursued.

"In the war we have had many examples of loss in production and servicing because common engineering standards have not existed. To quote one case—during the year 1944, over 45,000 taps of over 70 different sizes of American threads were called for at short notice at the service stations of the United States Army Air Force in the United Kingdom. They had to be made practically by tool room methods. You will know also that it was impossible to supply an oxygen cylinder produced in the United Kingdom for use in American aircraft without the provision of a special adaptor and this applies to other gases. One company alone in the United Kingdom was involved, during the war, in making 100,000 special outlet valves which were fitted to American cylinders, the American valves being taken out on receipt of the cylinder from America and scrapped. Peace will have losses of this kind, but they can be forestalled, with material benefit to international trade.

"So we believe that this work will go on, although the present conference is probably the last to be held under the ægis of C.P.R.B. In that latter respect there is no cause for grief. C.P.R.B. was designed for war, to operate in conditions of over-riding Government control. Essentially progress in engineering standards relies on voluntary cooperation in industry. The standards and rules in each country are the outcome of this cooperation, seeking to advance the application of engineering science and its contribution to human betterment. It is best for those familiar at first hand with working conditions, whose lives are devoted to the needs of industry, to reconcile the initiative and ingenuity of the designer with the convenience of standardization.

"C.P.R.B. may take pride in the begininngs of this work, in which representatives of the three countries, expert and lay, have met together in good will and to good purpose."

ENGINEERS PROPOSE PROGRAMME OF CONTROL FOR GERMAN INDUSTRY

Not long ago there was a press reference to a proposal put forward by the officers of certain American engineering societies for the control of German industry. Recently, copies of the complete report have been released, and it is now possible to tell members of the Institute more about it.

The full title is "Industrial Disarmament of Aggressor States (Germany)", and the report is made by the National Engineers Committee of the Engineers Joint Council. This latter body is a joint committee of five engineering organizations which has been in existence for several years as a medium for discussion of problems common to engineering organizations. Up until recently it has been known as the Engineers Joint Conference Committee. The member organizations are American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, American Institute of Electrical Engineers, and the American Institute of Chemical Engineers.

The report was based on a memorandum from E. R. Stettinius, Jr., Secretary of State, to the Engineers Joint Conference Committee, which reads as follows:

"The Department of State invites the Engineers Joint Conference Committee to prepare studies and proposals bearing upon the industrial disarmament of aggressor states.

It is the belief of the Department of State that factual studies which can be made available through the cooperation of the membership of your various Engineering Societies will be most useful in the Government's consideration of this problem.

It is of urgent importance that this work go forward rapidly. For the purpose of most effective integration with the factual studies which are in course of preparation within the Government, it is requested that the Engineers Joint Conference Committee frame its programme of work in consultation with the appropriate officers of the Department of State and the Foreign Economic Administration."

The report outlines a five-point programme of strict control from raw materials to processing and scientific research, all within the framework of the Yalta and Potsdam agreements. They are in brief—

I. A broad primary control, based on allocation of energy.

II. Raw material elimination or limitation, applied to specific elements critical to war industry.

III. Processing, fabricating and new construction controls; plus supplemental measures based on control of:

IV. Scientific research, and

V. Economic subsidies.

The report states, "complete elimination of German industries, leaving agriculture as the sole occupation, would produce an economic dislocation and social chaos of destructive magnitude, not alone in Germany but throughout Europe", and would not be supported by world opinion.

The framers of the report conclude with these words:—

"If the Control Council in Germany will institute and maintain effective controls of power production and distribution and industrial plant construction to

(1) Prohibit the synthetic fixation of nitrogen;
(2) Prohibit the production of synthetic liquid fuels;
(3) Prohibit the production of aluminum;
(4) Prohibit the use of atomic energy;
(5) Limit the capacities and production of steel and steel products plants,

such procedures will establish a considerable measure of assurance against the danger of German rearmament.

"Employment of the total German peacetime labour force will be reduced about five per cent by the prohibitions and controls herein recommended. There should be no serious problem in the re-employment of such a small percentage of labour in German peacetime agriculture and consumer goods industries.

"These recommended procedures are not intended as a substitute for the protection afforded by an adequate police force of the United Nations in Germany. Freedom from fear of rearmament will be attained only so long as such a police force remains in authority.

"For the guidance and direction of the policing forces there should be established a group of technological specialists who will keep informed as to German industrial and research activities."

In all there are 45 pages including tables and appendices. It is interesting reading to anyone who is more than casually interested in this problem. It has a particular interest to engineers because of the authorship. It is not often that engineers get together to render a national service of this kind or that their efforts are so well received by government. New ground has been broken here, and engineers everywhere may well ponder the significance of it.

CORRESPONDENCE

More About Remuneration

September 12th, 1945

Dr. L. Austin Wright,
The Engineering Journal,
Montreal, Que.

Dear Sir:

I would like to congratulate you on the publication of criticism of the old story "Engineers—A Dime a Dozen", particularly at a time when it is going to be used more and more frequently judging from present trends.

The examples given were good, however for further examples you need only have referred the reader to pages 548-9 of the same August issue of the *Journal.*

The fact that a great number of advertisements for engineers at rock bottom wages make their appearance in technical journals within a few days after the government had announced retention of exit permit and salary fixing regulations is, to put it mildly, significant, in fact it would almost suggest collusion.

Even though not one reply were received to any of these ads the impression would be left in other employer's minds that these offerings were in the top wartime range.

Continue and enlarge such attacks as the "dime a dozen". I suggest some comment on the present depressing and limiting regulations on engineers by the federal government as exemplified in their indefinite continuance of the exit permit and salary fixing regulations. Depressing need I add, not to industry or commission. You have to experience personally the self satisfied leer with which a manager, for the fourth year tells you, "My dear John, much as I would like to raise your salary, my hands are tied." At the same time he takes on an increased car allowance for himself, or the company might buy his car at the same time, and even buy his house at an inflated price.

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

P.S. Do not use my name for obvious reasons.

Members in London

Khaki University of Canada,
Canadian Army Overseas.
October 8th, 1945.

General Secretary,
The Engineering Institute of Canada,
2050 Mansfield Street, Montreal, Que.

Dear Sir:

On Thursday last, Lieut.-Col. H. O. Monk, Capt. A. C. Campbell and myself were invited to the installation of the president of the Institution of Electrical Engineers. After the luncheon held at the Waldorf, Sir John Anderson spoke briefly, warning that atomic power would not be applied directly to industrial uses in the near future. For some time to come, all that can be expected from atomic power is the generation of steam.

At the installation, the incoming president, Dr. Dunsheath, spoke of the electrical engineer's part in the war just past. In one hour he covered the whole field. The generation of power, development of anti-magnetic mine devices, and radar were the highlights. It is interesting to note that of all power outages caused during the war, only 17 per cent were attributable to enemy action while 43 per cent were caused by defensive measures, i.e. barrage balloons dragging their moorings and falling shell fragments.

The radar equipment was very interesting. A polar scanning tube was demonstrated and Klystron and Magnetron tubes exhibited. Among those present were Sir John Anderson, Sir Alexander Fleming, Ferranti, Sir Harry Railing, past-president, Professor Fortescue and Professor Moullin.

Numerous prizes were presented to men who had made some outstanding contributions to electrical science in this country during the past year.

Yours truly,

(Signed) A. C. Davidson (Lieut.) R.C.E., M.E.I.C.

A NATIONAL ORGANIZATION FOR COMMUNITY PLANNING

A letter sent recently by the Institute to all provincial representatives at the Dominion-Provincial Conference on Reconstruction is reproduced herewith. This recommends support of the suggestion made by the Honourable Mr. Louis St. Laurent that a national organization be created to foster community planning, and offers the assistance of the Institute in such an endeavour.

This support from the Institute is in line with the resolution passed at the annual meeting at Winnipeg, wherein such an organization was proposed. It is to be hoped that the provinces will accept the federal offer, and will join in the support which is essential to complete success.

Dear Sir:

At the Dominion-Provincial Conference on Reconstruction, on the afternoon of August 6th, the Honourable L. S. St. Laurent, Minister of Justice, concluded his outline of federal proposals for community planning with these words — "In particular, the Dominion is prepared to support in principle the establishment of a community planning institute for Canada, or some similar body, for the coordination of planning and action in this field on a continuing basis".

This offer is of great interest to the engineers of Canada, and to The Engineering Institute of Canada. We believe that some such organization can be developed into an instrument of great significance and usefulness. Through it the subject can be examined in its broadest aspects, and informed opinion placed before the public without prejudice or bias.

The fact that most people spend their lives in communities, either urban or rural, and that proper local land-use is essential to proper living, makes community planning a subject of vital importance to every government and to every citizen. Furthermore, with the preparation of suitable plans a local duty, the enactment of enabling legislation a provincial responsibility, and with community planning the basis of protection for housing under the National Housing Act, it is evident that team work is essential among governments, societies and the general public if success is to be achieved.

The Engineering Institute of Canada believes that a planning organization, which will permit the participation of all interested groups and individuals, will be in Canada's best interest because of the cooperative thinking, the accumulated knowledge and the general understanding it will afford.

I quote herewith a resolution passed at the 1945 annual meeting of the Engineering Institute, which indicates to you our interest, and our acceptance of responsibility in this subject.

"That this session of the annual meeting of The Engineering Institute of Canada held in Winnipeg on February 7th, 1945, wishes to place itself on record as acknowledging the responsibility of the profession and the Institute in the vital subject of community planning. It recommends that the Council of the Institute establish immediately a committee to develop and administer a programme of activities whereby the Institute may make the maximum contribution to the solution of the many problems present in all parts of Canada. This programme should include encouragement and support of a planning institute at the national level, development of interest in local problems by each branch, and publicity on a local and national basis that will inform the public as to what is in its best interest, and of the engineer's concern for its welfare."

We trust that when the Conference resumes this fall, you will give support to Mr. St. Laurent's proposal. I am instructed by the Council of the Engineering Institute to assure you and your confreres that the Institute will be glad to take its place behind you in establishing such a body, and to cooperate whole-heartedly with other organizations whose participation is essential to the success of such an enterprise. With our membership of over 7,000 professional persons, we believe we can be of substantial assistance.

A letter similar to this is being sent to the representatives of the other provinces and to Mr. St. Laurent. We will be very happy to know that we can be of assistance.

Yours sincerely,

L. Austin Wright,
General Secretary.

LIST OF NOMINEES FOR OFFICERS

The report of the Nominating Committee, as accepted by Council at the meeting held on September 15th, 1945, is published herewith for the information of all corporate members as required by sections 19 and 40 of the by-laws:

LIST OF NOMINEES FOR OFFICERS FOR 1946 AS PROPOSED BY THE NOMINATING COMMITTEE

President	J. B. Hayes	Halifax
Vice-Presidents:		
* Zone "B" (Province of Ontario)	W. R. Manock	Fort Erie
* Zone "C" (Province of Quebec)	G. F. Layne	Quebec
* Zone "D" (Maritime Provinces)	C. M. Anson	Sydney
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 Peninsula Branch	P. E. Buss	Thorold
† Sarnia Branch	G. L. Macpherson	Sarnia
† Sault Ste. Marie Branch	C. Stenbol	Sault Ste. Marie
† Winnipeg Branch	D. M. Stephen	Winnipeg
† Lethbridge Branch	C. S. Donaldson	Lethbridge
† Calgary Branch	J. G. MacGregor	Calgary
† Victoria Branch	Kenneth Reid	Victoria

* One vice-president to be elected for two years.
† One councillor to be elected for two years.
§ One councillor to be elected for three years.
‡ Two councillors to be elected for three years each.

NEW HEADQUARTERS

The Institute of Aeronautical Sciences with Headquarters in New York is now preparing to move from the Offices in the R.C.A. Building, which it has occupied since its inception, to new premises at the corner of Fifth Avenue and Sixty-Fourth Street.

A short time ago, officers of the Engineering Institute had the pleasure of preliminary inspection of the building, under the guidance of Major Lester D. Gardner, chairman of the Council. Both from the exterior and the interior, it is a handsome property, and upon completion of extensive alterations will afford magnificent facilities.

The Aeronautical Institute has an extensive library and museum, both of which can be housed and exhibited to advantage in their new location. The building also provides ample space for reading rooms, lounges, lecture halls, committee rooms, and offices.

These new quarters will probably be the most outstanding and commodious of any professional technical society in North America.

NEW APPOINTMENTS

Committee on the Young Engineer

At the September Council meeting appointments of new officers were made in connection with two of the Institute's most important activities.

Lieutenant-Colonel LeRoy F. Grant of Kingston, Ont., was appointed chairman of the Committee on the Training and Welfare of the Young Engineer, succeeding the late Harry F. Bennett. A graduate of Royal Military College and of Queen's University, Colonel Grant taught engineering at R.M.C. for nearly twenty years and in 1940 he became General Staff Officer of Military District No. 3 at Kingston. In the First Great War he served with the Canadian Overseas Railway Construction Corps.

Colonel Grant is particularly well qualified to direct the activities of the Committee on the Young Engineer, not only because of his knowledge of the problems and the reactions of the younger section of the profession, but also because of his experience in Institute affairs. He has always been actively interested in the Kingston Branch, having served as secretary - treasurer, and as councillor of the Institute in 1938, 1939 and 1940. He was one of Ontario's vice-presidents in 1943 and 1944.

Lieut.-Col. L. F. Grant, M.E.I.C.

de Gaspé Beaubien, C.B.E., M.E.I.C.

The Committee on the Training and Welfare of the Young Engineer was established in 1939 under the inspiration of President H. W. McKiel. Since then and up until Mr. Bennett's sudden death last January, it has done a large amount of work which stands as a tribute to the intelligent activity displayed by its late chairman. Vocational guidance at the high school level has been provided by the establishment of Student Guidance Committees in all of the branches. A pamphlet on the profession of engineering in Canada, has been printed, both in English and in French, and has been widely distributed. It has been adopted by the Canadian Legion Educational Services for their work among service men. With the encouragement of the Committee, new Junior and Student Sections have been established in several of the branches. The Committee has sponsored the distribution, among graduating classes at the various universities, of literature dealing with the professional aspects of engineering. The framework of the Committee, with its branch organization across the country, has been used by the government in its selection of candidates for the grants-in-aid to engineering students.

The Committee

on the Young Engineer has been one of the most active among Institute committees in recent years. The new chairman may be assured of the support of all members in the achievement of the high objectives which he has set himself in order to maintain the standards already established.

BEAUBIEN ON E.C.P.D.

To succeed Dr. Arthur Surveyer whose term of office expires this year, Council has appointed Dr. de Gaspé Beaubien, immediate past-president, as one of the three Institute's representatives on the Engineers' Council for Professional Development.

The more or less established practice of appointing past-presidents to this important international body, insures that our representatives are well versed in Institute affairs, and familiar with the aspirations of our entire membership as a result of their visits with the branches.

The Institute has been a constituent member of E.C.P.D. since 1941, and in addition to having representatives on the Council, it is also represented by one member on all committees except the one which deals with the accrediting of engineering schools in the States.

E.C.P.D.'s annual meeting is being held in New York on the 19th and 20th of this month and it is expected that most of the Institute's representatives will be present.

MEETING OF COUNCIL

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

Present: President E. P. Fetherstonhaugh (Winnipeg) in the chair; Vice-Presidents J. E. Armstrong and E. V. Gage of Montreal; Councillors A. Cunningham (Kenogami)) R. S. Eadie (Montreal), R. C. Flitton (Montreal), J. A. Lalonde (Montreal), R. A. Low (Kingston), C. A. Peachey (Montreal), W. L. Saunders (Ottawa), J. A. Vance (Woodstock), Treasurer R. E. Chadwick (Montreal), S. W. Gray, secretary-treasurer of the Halifax Branch of the Institute and of the Association of Professional Engineers of Nova Scotia; John G. Hall (Toronto), chairman of the Membership Committee; J. B. Stirling (Montreal), chairman of the Montreal Branch and of the Committee on Professional Interests. Secretary-Emeritus R. J. Durley, General Secretary L. Austin Wright, Assistant General Secretary Louis Trudel, and Major D. C. MacCallum, Headquarters Rehabilitation Officer.

Death of Two Past Vice-Presidents. Councillors present noted with sincere regret that within the last month two past vice-presidents of the Institute had passed away, George R. MacLeod of Montreal, and Henry G. Acres of Niagara Falls. It was unanimously agreed that Council's appreciation of the services rendered to the Institute by each of these gentlemen be recorded in the minutes of this meeting in the following form:

Henry G. Acres, D.Sc., M.E., E.E.

Henry G. Acres was not only outstanding in the field of consulting civil engineering but he was also outstanding in the activities of the Institute. In a period of thirty years' membership he made substantial contributions to the life of the Institute and to its service. He never refused a request from Council or from Headquarters for assistance, and he gave very generously of his time to these things which were of interest and assistance to the members. In the years 1921 and 1922 he served as vice-president for Ontario.

To Mrs. Acres, Council sends its heartfelt sympathy. It realizes how great is her loss, but expresses the hope that the recollection of the full and unselfish life which he lived will, to some extent, lighten her grief.

George R. MacLeod, B.Sc.

For almost fifty years George R. MacLeod was an active member of the Institute, having joined as a Student in 1897. He served on committees of the branch and of Council and in 1929 and 1930 was vice-president for the province of Quebec. His loyal and enthusiastic support of all things that were in the best interests of the profession was of genuine assistance to the Montreal Branch. He will be missed in Institute circles, and Council wishes to take this opportunity to express to Mrs. MacLeod its regret at his sudden passing and its sympathy with her in her bereavement.

Column Research Council A.S.C.E. It was noted that Dr. P. L. Pratley and Mr. R. S. Eadie had accepted the invitation to represent the Institute on the Column Research Council now being organized under the auspices of the American Society of Civil Engineers. After some discussion it was unanimously resolved that Dean J. N. Finlayson of Vancouver be nominated as the Institute's third representative on that Council, thereby giving representation to Canadian universities, which was considered most desirable.

International Federation of Engineering Institutions and Societies. The general secretary reminded Council that some time ago he had communicated with the leading engineering societies in Great Britain to ask what their attitude was towards the proposed new International Federation of Engineering Institutions and Societies. The replies received indicated that the British institutions were not interested. In their opinion there were already as many societies as were required, and they were more interested in cementing relations with existing organizations than in setting up any new body. This report was noted.

Rehabilitation of Members in the Armed Forces. The general secretary reported that the rehabilitation department had developed into a major activity. A great many members were calling at the office for interviews, and others were keeping in touch by correspondence. He explained that there were indications that some of the departments of government would like the Institute to extend its service to non-members. He reported that he and Major MacCallum had been invited to appear before the Royal Commission on Veterans' Qualifications, and in response to the chairman's inquiry, as to what the Institute was doing towards rehabilitation, Major MacCallum had described in some detail the work being carried out by his department.

The chairman of the Commission expressed his pleasure on hearing of such an excellent service, and after a discussion with the liaison officers representing the three active services, he asked if the Institute would consider extending its counselling and employment service to other engineers even though they were not members of the Institute.

It had been explained to the Commission that the service had been developed solely for Institute members, and that the existing facilities would be overtaxed if the field were widened, but if the armed sevices could make good use of the counselling services, the Institute would probably be prepared to make them available. Offers to this effect had already been made on several occasions.

The chairman of the Board asked for 300 copies of the Institute's questionnaire and pamphlet. These had been supplied, and have been distributed by the services to their counselling officers and as an outcome it seems that additional copies of the pamphlet would be in demand. Already the Naval Service have asked for 1,000 more.

In the Council's discussion which followed, it was evident that they did not believe it advisable to attempt to expand the Institute's employment service beyond the members of the Institute, but it was also agreed that the material in the pamphlet should be made available to the services and to the Department of Veterans' Affairs for reprinting in any quantities that they would require.

Major MacCallum sketched an outline of the activities in his department, and stated that shortly he would present a complete summary for the first six months service. He reported that members of the Institute were making excellent use of the service, and that many persons had been in to see him who were not members of the Institute, but who had asked for assistance and at the same time asked for application forms for membership. He stated that applications for assistance were being received at a rate of 20 a day, and interviews were averaging 10 a day. Not all of these were from the armed services; several were from civilian engineers desiring to change from wartime to peacetime occupations. He reported that there were also demands from non-members for advance copies of the Employment Page of *The Engineering Journal*, which ordinarily were being sent on the advance basis only to members. It was agreed that this list should not be circulated in advance of its appearance in the *Journal* to any persons other than members. It was pointed out that the Wartime Bureau of Technical Personnel had been established by the government to take care of the professional workers and the engineers and scientists in the services, and that the Institute should be careful not to invade this field. Council was reminded that the service had been established originally to give additional help to Institute members only.

Committee on Professional Interests. Mr. Stirling, chairman of the Committee on Professional Interests reported that although there had been no plenary meeting of his committee during the summer, there had been a certain amount of correspondence and several informal discussions, between himself and members. He reported briefly on two meetings which he had with the officers of the Institute branches and the provincial associations in Halifax and in Saint John, at which a number of subjects of importance to the profession were discussed. He gave a list of these subjects and of the opinions expressed, all of which was very informative and encouraging to Council.

Mr. Stirling also presented to Council an item relating to a proposal to publish advertisements which the Quebec Corporation of Professional Engineers has recently announced in its monthly Bulletin. This proposal had also been presented at the annual meeting of the Dominion Council, at which time it was announced that the Association of Professional Engineers of Ontario and the Corporation of Professional Engineers of Quebec had agreed to launch a joint advertising programme, through which it was hoped to increase the public awareness of the desirability or necessity of all engineers being members of a provincial registration body. He circulated copies of four of the advertisements which had been prepared for publication.

In his opinion this was a matter worthy of the attention of Council inasmuch as nothing of this kind could be done without affecting the entire profession. He thought the Council should give consideration to the proposal and to the advertising copy. He then asked the general secretary to report on an informal meeting of committee chairmen at which this same subject had been discussed in some detail.

The general secretary stated that at the meeting to which Mr. Stirling had referred there were present four of the senior officers of the Institute, including one past-president. Generally speaking, the group was unanimous in believing that, in view of the co-operative agreement, the subject should be discussed with the Corporation. There were several points raised that indicated the possibility of advantageous changes being adopted that would make the presentation more professional and therefore more acceptable to the public and to the profession.

Several members of Council expressed themselves on the copy and on the proposal to advertise, and eventually it was agreed that Mr. Stirling should discuss this subject with the officers of the Corporation.

It was agreed further that Mr. Stirling through his committee should notify the Dominion Council of the Institute's interest and action, so that there would be no possibility of any misunderstanding; and at the same time he should advise directly the provincial associations with which the Institute has co-operative agreements.

Community Planning. The general secretary explained that a chairman for the Committee on Community Planning had not yet been secured, although he had been following up one or two good suggestions. Up to the present time all those persons who had been approached had been too busy with other things to undertake this additional work.

Following some discussion it was agreed that the search for a suitable chairman be continued and that councillors be asked to send to the general secretary any suggestions they may have to offer.

Bennett Memorial Fund. Mr. Vance reported that his committee now consisted of E. V. Buchanan of London, R. E. Heartz of Montreal, and himself as chairman. He has had several meetings with Mr. Buchanan in London and one meeting with Mr. Heartz in Montreal. A great deal of information had been gathered regarding the establishment and administration of similar funds. This had been carefully studied and the committee presented a progress report for the consideration of Council, which was accepted.

Canadian Radio Technical Planning Board. In response to instructions given by Council at the June meeting, Mr. Peachey reported on the Canadian Radio Technical Planning Board and the relationship between it and the Engineering Institute. He stated that the primary function of the Board was to establish a means by which the opinions of informed persons and organizations interested in allocation of frequencies for radio and allied work could be assembled and appraised. It was expected that the Department of Transport, on behalf of Canada, would have to handle these issues at an international conference. The Radio Technical Planning Board was being used to secure for the Department the correct information. It was made up of twelve non-profit organizations, each of which contributed $250.00 to finance its operations.

Six panels had been formed, five of them to study the various phases of radio work from a frequency standpoint, the sixth to receive the recommendations from the other five and to pass them on to the administrative committee for approval.

Mr. Peachey thought the Institute should accept the invitation to become a sponsoring member as the business being handled would constitute some of the major engineering problems for the country at large. As a member the Institute would receive the reports of the various panels and of the Board which would be placed in the library for the use of members. He believed also that much of the material would be of considerable value to *The Engineering Journal*

Mr. Peachey went on to point out that the Institute now has a member on each one of the six panels and he recommended that these gentlemen be asked to carry the Institute's representation rather than appoint six additional ones.

In conclusion Mr. Peachey recommended strongly that the Institute make the necessary contribution and that it lend its weight to the whole activity. In this way, not only would the Institute be assisting the effort but it would be making available to members interested in radio work, contacts and information which would not be available otherwise.

Mr. Armstrong, on behalf of the Finance Committee, stated that if Council wished to approve of this proposal he believed the money could be found without difficulty.

Mr. Vance thought that it was a very wise move inasmuch as it would be a definite indication of the Institute's interest in radio engineers and engineering. Finally, on the motion of Mr. Peachey, seconded by Mr. Lalonde, it was unanimously resolved that the Institute should become a contributing sponsor of the Canadian Radio Technical Planning Board and that members of the Institute on the various panels be asked to represent the interests of The Engineering Institute of Canada as well as the other interests they already represent.

The Council adjourned for lunch at 12:45 and reconvened at 2 o'clock with the president in the chair.

Report of Membership Committee. Mr. Hall, chairman of the Membership Committee, presented a report recommending certain amendments and additions to the by-laws. These proposals covered suggested changes in the procedure for the transfer of Students and Juniors to higher classifications, and the establishment of an Admissions Committee to consider all applications for admission and transfer before they are presented to Council. These recommendations were made after a careful study of replies received from various members, branches, etc., relating to the preliminary report published in the *Journal* following the annual meeting of Council in February last.

The proposed amendments are not yet in their final form, but before preparing the final draft the committee would like to have the benefit of the opinions of the branches and councillors.

Mr. Hall commented briefly on the various recommendations and after some discussion on the motion of Mr. Armstrong, seconded by Mr. Eadie it was unanimously resolved that the report be accepted with a view to its progression towards the formation of the by-laws to bring it into effect.

At this point Mr. Hall had to leave the meeting to catch a train to Toronto and the Council then reviewed briefly the various items in the report. It was finally decided that a copy of the report should be sent to all councillors and all branches, with a request for comment and criticisms which would be helpful to the committee in preparing its final draft of proposed amendments for submission to the membership.

Committee on the Young Engineer. The general secretary reported that Colonel L. F. Grant of Kingston, had accepted the chairmanship of the Committee on the Training and Welfare of the Young Engineer, and presented a report prepared by Colonel Grant following a meeting in Ottawa with Mr. Kirkconnell (C.I.M.M.) and Mr. Green (C.I.C.), the other two members of the Joint Counselling Committee, of which Colonel Grant had also accepted the chairmanship.

(1) That the joint committee should issue a second bulletin to counsellors as soon as possible.
(2) That the secretary of the committee, Mr. Kirkconnell, should write the three Institutes asking them to assume the responsibility of maintaining their personnel in the various groups of counsellors, making the necessary replacements of those who retire from time to time.
(3) That the chairman should write the Engineers' Council for Professional Development asking about progress of aptitude tests which information would be circulated.
(4) That a new booklet should be issued to replace the one formerly produced by the Institute's committee "The Profession of Engineering in Canada", it being agreed that the cost of such a booklet should be divided between the three institutes in the proportion of fifty per cent to the Engineering Institute and twenty-five per cent to each of the other two.

Following some discussion Colonel Grant's report was accepted and approved unanimously, with the exception of the suggestion regarding the proposed new booklet, which the general secretary was directed to discuss with Colonel Grant before any decision was reached.

Proposed Student Conference. The general secretary reported that from replies received it was evident that the undergraduate engineering societies at the various universities were enthusiastic about the student conference to be held at the time of the Institute's annual meeting in February next. As soon as the colleges are open the matter will be followed up in greater detail.

"Mulberry" Exhibition. The general secretary reported that the Mulberry Exhibition, now open in Ottawa, would open in Montreal on October 3rd, and proceed to Toronto at the end of the month. In Ottawa the exhibtion was a great success, an average of over 3,000 people attending each day to the total of 45,000.

Mr. Wright explained that the Institute's request to show the exhibition in Canada had been received in England just after permission had been given to the Hudson's Bay Company. The company had immediately agreed to collaborate with the Institute in showing the model across Canada, and although the Institute is sharing in the work and responsibility, the Hudson's Bay Company is taking care of the costs. In view of the company's generosity it was agreed to record the Institute's appreciation as follows:

Moved by Mr. Vance, seconded by Mr. Flitton and carried unanimously:

"The Council of The Engineering Institute of Canada has a real appreciation of the cordial and co-operative manner in which the Hudson's Bay Company has, through Mr. P. A. Chester, carried out the arrangements for the sharing of the Mulberry model across Canada. Under such circumstances it is a genuine pleasure to work on this interesting project in collaboration with the Company.

The Company's generosity in matters relating to costs has made it possible for the Institute to participate and to take some modest share in the work involved.

The Institute hopes, with the Company, that their common objective of promoting goodwill within the Empire will be advanced materially by this Trans-Canada exposition."

Committee on Employment Conditions. In the absence of the chairman of the Committee on Employment Conditions, Mr. R. E. Heartz, the general secretary presented a written report, which brought Council up to date on all matters relating to collective bargaining. This appears elsewhere in this issue.

On the motion of Mr. Eadie, seconded by Mr. Armstrong, it was unanimously resolved that the report of the Committee on Employment Conditions be accepted and approved.

A New Building for Headquarters. There have been several informal discussions by the House Committee and the Finance Committee as to the possibility of enlarging the Headquarters premises; or, of erecting a much larger building, which would more nearly meet the Institute's requirements and be available for all engineering activities in Montreal. Mr. Armstrong described briefly the space available on each floor of the present building which is entirely inadequate. Following some discussion it was agreed that the Library and House Committee be asked to look into the question of premises and endeavour to bring in a report at the annual meeting of Council in February next. This meeting would be held in Montreal, and would give out-of-town councillors an opportunity to look over the present building.

Financial Statement. It was noted that the financial statement to the end of August had been examined and approved.

Proposal to Increase Fees. Mr. Armstrong reported that in accordance with authority granted at the May meeting of Council, the Finance Committee had issued a memorandum to all branch executive committees with a view of securing their opinions in regard to increasing the annual fees of the Institute and the income to the branches. Upon receipt of replies the Finance Committee will prepare a final report to Council with suggestions regarding any proposed changes in the by-laws which might seem advisable. Mr. Armstrong's suggestion that a copy of the memorandum be sent to all councillors was approved. This progress report of the committee was noted.

Proposed Alterations to Headquarters' Building. The House Committee had recommended certain alterations and repairs to the Headquarters building and had submitted tenders covering this work. On the recommendation of the Finance Committee it was unanimously agreed that the necessary appropriation for this work be made.

Billing of Returned Service Men. On the recommendation of the Finance Committee it was unanimously agreed that members returning from overseas, from now until the end of the year, should not be billed for any part of the annual fee for 1945.

Annual Meeting, 1945. The general secretary reported that a cheque for $200.00 had been received from the Winnipeg Branch representing a surplus on the branch financing of the last annual meeting. This was noted with much appreciation.

Committee on Soil Tests. The general secretary presented a letter from Mr. R. E. Chadwick explaining that he found it impossible to continue as chairman of the Committee on Soil Tests, an appointment which he had accepted at the time of the annual meeting in Winnipeg.

Following some discussion it was decided to accept Mr. Chadwick's resignation, but to leave the appointment of a new chairman until the next meeting of Council.

Engineers' Council for Professional Development. It was unanimously resolved that Dr. deGaspé Beaubien be nominated as the Institute's representative on the Engineers' Council for Professional Development to replace Dr. Arthur Surveyer whose term of office expires this year.

Overage Applicants for Student Membership. It was unanimously agreed that applications for Student membership from ex-servicemen who are now overage for the class of Student be accepted.

Resolution from the Moncton Branch. The general secretary presented a letter from the executive of one of the branches asking Council to take up with the proper authorities the question of an alleged discrimination against two members of the branch. It was unanimously agreed that the matter be referred to Vice-President E. V. Gage and Mr. R. E. Heartz, chairman of the Institute's Committee on Employment Conditions, with power to take the necessary action.

Planning for Ottawa Federal District. The attention of Council was drawn to an announcement in the press to the effect that the planning for the Ottawa Federal District and the war memorial is to be undertaken by a non-Canadian. The Ottawa chapter of the Royal Architectural Institute of Canada contemplates making a protest, and it has been suggested that the Engineering Institute might be interested in joining with that body. Following some discussion, it was unanimously agreed that the matter should be referred to a small committee consisting of Mr. W. L. Saunders of Ottawa, and Mr. R. A. Low of Kingston, with power to take whatever action seems desirable.

Government Housing Scheme. Mr. Armstrong reported that his attention had been drawn to the unfairness in the operation of the so-called Government housing scheme. It had been suggested to him that the Institute Council might take some action. He quoted instances where the scheme did not work out to the advantage of either the municipalities or the individuals. Following some discussion it was decided that the matter should be brought up at a later meeting of the Council, with more specific information.

Annual Meeting 1946. As chairman of the Annual Meeting Committee, Mr. Flitton made a brief report. It was expected that the ban on transportation would be lifted very shortly, and it was hoped that by the time of the annual meeting the hotel situation would be greatly improved. His committee was getting under way and regular meetings would be held from now on.

Applications Through Associations. A letter was presented from a branch executive drawing attention to the case of a candidate whose application for membership in the Institute had been declined, but who upon making later application to the Provincial Association of Professional Engineers had been accepted as a member of that body, thus automatically giving him membership in the Engineering Institute. It was agreed that the general secretary should write to the Association regarding this case.

It was noted that the next meeting of Council would be held at the Prince Edward Hotel, Windsor, Ontario, convening at nine o'clock a.m.

ELECTIONS AND TRANSFERS

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

Members

Batzold, Jack Carter, B.Sc., (Mech.), (Queen's Univ.), managing-dir., Sprostons, Ltd., Georgetown, Demerara, B.G., S.A.

Bell, Norman, B.A.Sc., (Chem. Engrg.), Univ. of British Columbia, M.S. (Chem. Engrg.), (Univ. of Michigan), asst. supt., ore plant No. 2, Aluminum Co. of Canada, Arvida, Que.

Bennett, Weston Taft, B.S., (Mech.), (Tuft's Coll., Medford, Mass.), chief engr., newsprint divn., Canadian International Paper Co., Montreal, Que.

Block, Frank, Mech. Engr., (Univ. of Vienna), designer, Dominion Bridge Co., Ltd., Lachine, Que.

Bowden, Henry Joseph, B. Chem. Engrg., (Univ. of Detroit), chief chemist, Abrasives Co. of Canada, Arvida, Que.

Boyle, John Edward, B.A.Sc., (Univ. of Toronto), inspecting officer, Inspection Board of the United Kingdom & Canada, c/o Defence Industries Limited, Cherrier, Que.

Braun, John Fridolin, leaving cert., structl. engrg., (Ecole Polytechnique, Zurich, Switz.), supt., ore plants, Aluminum Co. of Can., Ltd., Arvida, Que.

Carey, Malcolm L., S.B., (Mass. Inst. Tech.), genl prod. supt. Aluminum Co. of Can., Ltd., Arvida, Que.

Corman, William E., Mech. Engr., (Univ. of Toronto), president & genl. mgr., Corman Engrg., Co., Ltd., Toronto, Ont.

Costantini, Donald Henry, B.Sc., (Civil), (Univ. of Manitoba) chief field constrn. engr. for mill divn., Brompton Pulp & Paper Co., Red Rock, Ont.

Dagg, Frank Anderson, B.Sc., (Civil), (Univ. of Manitoba), supt., atomizing plant, Aluminum Co. of Can., Ltd., Isle Maligne, Que.

Fodor, Nicholas, B.A.Sc., (Univ. of Toronto), mech. engr., i/c engrg. dept., Canadian Synthetic Rubber Ltd., Sarnia, Ont.

Garvin, Albert Lorne, designing dftsman., Consolidated Mining & Smelting Co., Ltd., Trail, B.C.

Gurney, Edward Holt, president, Gurney Foundry Co., Ltd., Toronto, Ont.

Hobner, Robert Henry, B.Sc., (Elect.), (Univ. of Manitoba), supt. of mtce., Defence Industries Limited, Jean Brillant, Que.

Jamieson, Edgar Archibald, Lt. Cmdr., R.C.N.V.R., Mech. & Elect. Engr., (Univ. of Toronto), Inspector Naval Ordnance, Vancouver, B.C.

Keppy, John C., district plant engr., The Bell Telephone Co. of Can., London, Ont.

MacIntyre, Thomas Moodie, B.Sc., (Civil), (Queen's Univ.), field engr., hydro electric power installn., British Columbia Power Co., Victoria, B.C.

McEachern, Sinclair, B.Sc., (Civil), (Univ. of Manitoba), asst. supt., Geo. W. Reed Co., Montreal, Que.

McGee, Richard Orville, B.Sc., (Met. Engr.), (Queen's Univ.), inspecting officer (materials), Inspection Bd. of U.K. & Canada, Ottawa, Ont.

McKeown, Raymond John, Lt. Cmdr. (E.), R.C.N.V.R., B.Sc. (Met. Eng.), (Queen's Univ.), Staff Officer, Engr. Personnel, Canadian Naval Mission Overseas, London, S.W.1, England. (Has returned from overseas.)

McNally, Patrick Jessett, B.Sc., (Mining), (Queen's Univ.), constrn. engr., E. G. M. Cape Co., Montreal, Que.

Napier, Charles Edward, B.Sc., (Mech.), (McGill Univ.), sales engr., Consolidated Engineer & Machinery Co., Ltd., Toronto, Ont.

Newland, Alfred, Lt. Cmdr. (E), R.C.N.V.R., (now demobilized. residing in England, c/o Ruston & Hornsby, Ltd., Lincoln, England).

Peebles, Andrew Auberon, S/L., R.C.A.F. Reserve, Provincial Inst. Technology and Art, Calgary, Alta.

Sauder, Frederick James, B.Eng., (Mech.), (McGill Univ.), asst. works supt., A/C divn., Canadian Car & Foundry Co. Ltd., Amherst, N.S.

Schroter, Bernard H., S/L., Chief Engr. Officer, R.C.A.F., No. 1 G. & N.S., Summerside, P.E.I.

Sorby, Walter Oswald, Major, B.A.Sc., (Univ. of Toronto), C.M.H.Q., London, England.

Steeves, Cecil Myron, B.Sc., (Elect.), (Univ. of New Brunswick), elect. engr., Sao Paulo Tramway, Light & Power Co., Ltd., Sao Paulo, Brazil, S.A.

Stewart, Charles Gordon, B.Sc., (Elect.), (Univ. of Manitoba), supvr., project staff, engrg. dept., Canadian Car & Foundry Co., Ltd., Fort William, Ont.

Thomas, John Wilbert, Major, Directorate of Engineer Development, N.D.H.Q., Ottawa, Ont.

Ussher, James William, B.A.Sc., (Chem.), (Univ. of British Columbia), area supvr., St. Maurice Chemicals Ltd., Shawinigan Falls, Que.

Weinreb, Marceli, M.Sc., (Univ. of Warsaw, Poland), asst. factory cost engr., Fairchild Aircraft Ltd., Longueuil, Que.

Wheaton, Isaac Gilbert, B.Sc., (Civil), mgr. of construction, Imperial Oil Ltd., Toronto, Ont.

Williams, William Alfred, B.Sc., (Mech.), (Univ. of Michigan), sr. engr., process. engr. and development dept., Imperial Oil Limited, Sarnia, Ont.

Juniors

Armstrong, George Ernest, Elect. Sub./Lt., H.M.C.S. Cornwallis, R.C.N.V.R., Cornwallis, N.S.

Brooks, John Alfred, B.Sc., (Chem. Engrg.), (Queen's Univ.), supvr., personnel and operations, Canadian Resins and Chemicals, Shawinigan Falls, Que.

DeWolf, Edward Gerald, Sub. Lt. (E), R.C.N.V.R., B.E., (Mining), (N.S. Tech. Coll.), H.M.C.S. Portage, c/o F.M.O., Halifax, N.S.

Drolet, John Paul, B.A.Sc., (Mining), (Laval Univ.), engr., Dept. of Mines, Quebec, Que.

Harrison, Victor Frank, B.Sc., (Chem.), (Queen's Univ.), Private, R.C.A.M.C., Canadian Active Army.

Junkin, Bruce Frederick, Elect. Lt., R.C.N.V.R., B.Sc. (Elect.), (Univ. of Manitoba), Sanford, Man.

McDiarmaid, Lorne Grant, B.Sc., (Chem.), M.Sc., (Chem.), (Univ. of Alberta), genl. mgr. & chief engr., Insulation Industries, Vancouver, B.C.

Moore, David Ian, Constructor Lt., R.C.N.V.R., Intermediate B.Sc. (Eng.), (Univ. of London, London, Eng.), Ottawa, Ont.

Nargang, John Walter, B.Sc., (Mech.), (Univ. of Sask.), mtce. engr., Aluminum Co. of Can., Ltd., Arvida, Que.

Wilson, Ronald S., Lieut. (E), R.C.N.V.R., B. Eng., (Mech.), (McGill Univ.), Chief Eng., H.M.C.S., St. Boniface, c/o F.M.O., Halifax, N.S.

Affiliate

Huyck, Charles Bertram, Major, R.C.E.M.E., General Engrg. Section, N.D.H.Q., Ottawa.

Transferred from the class of Junior to that of Member

Buchanan, Arnold Amherst, W/C., R.C.A.F., B.Eng., (McGill Univ.), Chief Engr. Officer, No. 1, S.F.T.S., Camp Borden, Ont.

Crane, George Joseph, B.A.Sc., (Elect.), (Univ. of British Columbia), development engr., Electric Reduction Co., Ltd., Buckingham, Que.

Johnson, James Richard, Lt. Col., B.Eng., (McGill Univ.), Officer Commanding Armoured Fighting Vehicle Tech. Staff., N.D.H.Q., Ottawa, Ont.

Love, Herbert Wainwright, O.B.E., Lt. Col., R.C.E., B.Sc., (Civil), (R.M.C., & Queen's Univ.), Main Hdqts., First Cdn. Army Overseas.

Peterson, Robert, B.Sc., (Civil), (Univ. of Saskatchewan), S.M., (Harvard Univ.), Soil Mechanics Engr., Univ. of Saskatchewan, Saskatoon, Sask.

Transferred from the class of Student to that of Member

Armstrong, Howard Elgin, Lieut., R.C.E., B.Sc., (Civil), (Queen's Univ.), 27 Fld. Coy., Debert, N.S.

Charters, Stewart Anderson, Capt., R.C.A., B.Eng., (McGill Univ.), Montreal, Que.

Heath, Frederick Johnston, B.Sc., (E.E.), (Univ. of Alberta), sr. radio equipment engr., R.C.A.F., c/o Inspection Bd. U.K. & Canada, Toronto, Ont.

McMullen, William Francis, Lt. Col., B.A.Sc., (Elect.), (Univ. of Toronto), Canadian Army Overseas.

Simard, Joseph Edmond, B.A.Sc., C.E., (Univ. of Montreal), cost engr., Marine Industries Limited, Sorel, Que.

Slipp, John Gillespie, F/L., R.C.A.F., B.Sc., (Elect.), (Univ. of Alberta), Signals Officer, Overseas.

White, Clifford Hubert, Elect. Lieut., R.C.N.V.R., B.Sc., (E.E.), (Univ. of Manitoba), Ottawa, Ont.

Transferred from the class of Student to that of Junior

Black, James William, (passed exams. under Sch. B(Chem.) of E.I.C.) sr. lab. asst., National Research Council, Ottawa, Ont.
Cook, Charles Henry, B.Sc., (E.E.), (Univ. of Manitoba), elect. engr., Defence Industries, Montreal, Que.
Cumming, John William, Lt. (E), R.C.N.V.R., B.Eng., (Civil), (McGill Univ.), Mtce. Officer, H.M.C.S. Protector, Sydney, N.S.
Hopps, John Alexander, B.Sc., (Elect.), (Univ. of Manitoba), radio supply officer, National Research Council, Hull, P.Q.
Hudson, George Waugh, B.Eng., (Elect.), (McGill Univ.), jr. radio engr., National Research Council, Hull, Que.
Logie, William Alexander, B.Sc., (Elect. Engrg.), (Univ. of New Brunswick), engr., relay dept., Hydro Quebec, Montreal, Que.
Macnab, Edward Nelson, Lieut. (E), B.Sc., (Elect.), (Univ. of New Brunswick), R.C.N.V.R., Newfoundland Command.
Murray, James Albert, B.Arch., (Univ. of Toronto), Staff, School of Architecture, Univ. of Toronto, Toronto, Ont.
Rochon, Andre, B.A.Sc., (C.E.), (Ecole Polytechnique), asst. supt., elect. dept., Marine Industries Ltd., Montreal, Que.
Sanderson, David Reynolds, B.A.Sc., (Univ. of Toronto), Gordon Wallace, consultg. engr., Toronto.
Waller, Milford John, B.A.Sc., (Univ. of Toronto), design engr., Northern Electric Co., Montreal, Que.
Aumont, Charles Edouard, B.A.Sc., (Ecole Poly.), 4614 Garnier St., Montreal, Que.
Bergenstein, Eric Gustav, (Univ. of Manitoba), 54 Noble Ave., Winnipeg, Man.
Deptford, James Arthur, B.A.Sc., (Univ. of British Columbia), 458 Concord St., Toronto, Ont.
Gershuny, Mitchell, (Univ. of Manitoba), 282 Redwood Ave., Winnipeg, Man.
Gronlund, Max Donald, B.A.Sc., (Mech.), (Univ. of British Columbia), 76 East Ave., North Hamilton, Ont.
MacNair, Donald Emerson, Jr., (Mass. Inst. Tech.), M.I.T. Dormitories, Cambridge, 39, Mass.
O'Grady, J. Robert, (Queen's Univ.), Cadet, R.C.E., Petawawa, Ont.
Pickard, James Thomas, B.A.Sc., (Univ. of Toronto), Box 472, Kentville, N.S.
Ramsey, Thomas Alfred, B.A.Sc., (Univ. of Toronto), 367 Indian Grove, Toronto, Ont.
Rowntree, Alan Keith, B.A.Sc., (Univ. of Toronto), 54 Glenwood Ave., Toronto, Ont.
Scott, Charles Elmer, (Univ. of New Brunswick), Univ. of N.B., Fredericton, N.B.
Scott, Ernest Maurice, (Univ. of Manitoba), 805 Alverstone Ave., Winnipeg, Man.
Shelson, William, B.A.Sc., (Univ. of Toronto), 22 Beatrice St., Toronto 3, Ont.

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

Ballantyne, Andrew George, B.Sc., (Civil), (Univ. of Alberta), jr. engr., P.F.R.A., Dept. Agriculture, Calgary, Alta.

NEW BRUNSWICK

Member

Laughlin, Harry Sheldon, B.Sc., (Univ. of New Brunswick), P. O. Box 44, Milltown, N.B.

Junior to Member

Cox, Kenneth Victor, B.Sc., (Elect.), (Univ. of New Brunswick), Fredericton, N.B.

NOVA SCOTIA

Member

Valde, Bertrand Alan, B.Sc., (Civil), (Univ. of Sask.), chief dftsman., hydraulic dept., Hydro Elect. Power Comm. of Ontario, Toronto, Ont.

QUEBEC

Member

Murray, John Alfred, B.A.Sc., (Univ. of Toronto), mfg. engr., electronics divn., Northern Electric Co., Ltd., Montreal, Que.

Junior to Member

Lecavalier, Joseph Fernand, B.A.Sc., (Ecole Poly.), aero. engr., Trans-Canada Air Lines, Montreal, Que.
Miller, John Jackson, B.Sc., (Elect.), (Univ. of Manitoba), chief elect. supvr., Canadian National Railways, Montreal West, Que.

Student to Member

Hodgson, Ronald Hugh Cleveland, B.Eng., (Mech.), (McGill Univ.), Capt., R.C.E.M.E., Montreal 25, Que.
Lessard. Roger, B.A.Sc., (Civil), (Ecole Poly.), mech. engr., United Shipyards, Ltd., Montreal, Que.
Salvas, Paul-Emile, B.A.Sc., (Civil), (Ecole Poly.), mech. engr., United Shipyards, Ltd., Montreal, Que.

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 a basis of personal items in the *Journal*.

J. S. Lochhead, M.E.I.C, has been appointed the Canadian director of Designers for Industry, Inc., Cleveland, Ohio, an organization combining all functions for the planning of successful products from conception to market. Mr. Lochhead graduated in civil engineering at McGill University in 1937. He served five years with Dominion Bridge Company as supervisor and inspector in the structural, boiler and mechanical shops. Leaving Dominion Bridge to specialize in planning he became supervisor of scheduling, primary tools and gauges, at Westmount Tool Works, Defence Industries Limited. When the small arms ammunition programme slackened, he went to Canadian Vickers Ltd., aircraft division. There he served as liaison planner in connection with shop order release, spare parts control and latterly in planning I.B.M. applications for the new Douglas Aircraft being made at Canadair for T.C.A. Mr. Lochhead will be located in Montreal.

Jules Archambault, M.E.I.C., has been appointed chief engineer of the Montreal Tramways Company. A graduate of McGill University, he commenced his engineering career with the Aluminum Company at Arvida in 1926 as technical assistant. After 1½ years' service he was appointed engineer with the Duke-Price Power Company. In 1929 he joined the Bell Telephone Company and worked in the transmission engineering department of the Quebec Division, later being transferred to the general commercial manager's office. After gaining experience in this department, he was assigned to make special studies for the company for a period of three years following which he became manager of one section of the Eastern Townships division.

In 1937 Mr. Archambault was appointed chief engineer of the Montreal Tramways Commission, a provincial government organization, which position he has held until his recent appointment. In 1942, at the request of the federal government, the Commission consented to his also carrying on the duties of Associate Transit Controller.

F. R. Pope, M.E.I.C., has been elected chairman of the Peterborough Branch of the Institute. Born at Montreal, Que., he graduated with honours from McGill University with the degree of B. Eng. (Mech.) in 1935. After graduation he became associated with the Bell Telephone Company of Canada, being employed in the capacity of field engineer. In 1938 he joined the staff of the Western Clock Company Limited at Peterborough and two years later was appointed assistant superintendent of the company, which position he holds at the present time.

F. R. Pope, M.E.I.C.

Mr. Pope joined the Institute as a Student in 1933, transferring to Junior in 1940 and to Member in 1945.

B. K. Boulton, M.E.I.C., who was named president of Wartime Housing Limited at Toronto, Ont., is undertaking a new emergency programme of 10,000 low-rent houses for servicemen. Mr. Boulton was previously employed as engineer with the Department of Munitions and Supply in the development of the atomic energy project at Chalk River, Ont.

Brigadier M. M. Dillon, M.C., M.E.I.C., has retired from the Canadian Army and has resumed his practice as consulting structural engineer at London, Ont. He served in the first World War from 1915 until 1919 with the Canadian Machine Gun Corps, when he was awarded the M.C. and Bar. From 1921 he was continuously active with the Canadian militia and was commanding officer of the Canadian Fusiliers (Machine Guns) at the outbreak of World War II. In 1940 Brigadier Dillon was transferred to the staff of the machine gun training centre for western Canada at Saskatoon, Sask., and in the following year became commanding officer of the unit. He later organized and commanded No. 6 Canadian Engineer Training Centre at Dundurn, Sask. In 1942 he was transferred to National Defence Headquarters at Ottawa and appointed director of trades training. In the following year he was promoted to his present rank and appointed deputy quartermaster general (B). In 1944 he became deputy quartermaster general (A) and officer administering R.C.E. In May last Brigadier Dillon was seconded to the Department of Veterans' Affairs to report on construction problems and to recommend a suitable organization for the engineering department.

Dr. deGaspé Beaubien, C.B.E., M.E.I.C., consulting engineer and immediate past-president of the Institute, has been appointed a member of the Real Estate Advisory Committee of War Assets Corporation. This committee will advise the Corporation regarding properties, lands and plants declared surplus and placed with the Corporation for disposal. Dr. Beaubien, because of his special qualifications, will deal with the engineering problems relating to the disposal of land and structures.

J. B. Gnaedinger, M.E.I.C., has been transferred from the mining department of the Aluminum Company of Canada Limited, to Aluminium Works Limited, an associated company. His position of mining engineer includes consulting work on mining and allied problems.

Capt. D. A. Lindsay, M.E.I.C., who has been serving with the Royal Canadian Engineers, is returning to civilian life and has accepted the position of district manager of the Maine and New Brunswick Electrical Power Company at Woodstock, N.B.

G. J. T. Gunn, M.E.I.C., formerly assistant utilities foreman with the Creole Petroleum Corporation at Caripito, Venezuela, has joined the staff of Robert A. Rankin & Co., consulting industrial engineers, Montreal, Que.

H. Thomasson, M.E.I.C., has been named head of the Physical Laboratory of the Canadian Westinghouse Company, Limited, at Hamilton, Ont. The company has re-organized the mechanical division of the engineering department for peace-time projects. **E. H. Tovee,** M.E.I.C., has been made head of the Materials and Process Section.

Jules Leblanc, M.E.I.C., has been appointed chief engineer of the Rural Electrification Bureau of the Province of Quebec. Mr. Leblanc was formerly chief examiner, Provincial Board of Electrical Examiners, and head of the Department of Electrical Inspection.

Colonel Jean P. Carrière, M.E.I.C., formerly deputy chief engineer of the 1st Canadian Army in Europe, has retired from the Army to the reserved list and has returned to the Department of Public Works, on the chief engineer's staff, at Ottawa, Ont. He was closely associated with the construction by the Royal Canadian Engineers of important bridges in Holland last spring and gives an account of his work in this issue of the *Journal.*

Flight-Lieutenant Allan Tubby, M.E.I.C., has been retired to the reserve of officers of the R.C.A.F. and is now employed as resident engineer in charge of construction of a townsite in northern Ontario for Defence Industries Limited. Before joining the R.C.A.F. he was employed as manager of the Ottawa branch and plant of Currie Products Limited, at Ottawa, Ont.

J. T. Thwaites, M.E.I.C., electronics engineer of Canadian Westinghouse Company, Limited, in Hamilton, Ont., has recently been appointed chairman of the Advisory Committee on Electronics of the Training and Re-establishment Institute of Toronto, Ont.

R. E. Jamieson, M.E.I.C., has resigned as director general of the Army Engineering Design Branch of the Department of Munitions and Supply at Ottawa. Under his guidance the Branch came forward with many advances in engineering design which contributed to victory. Mr. Jamieson will remain a member of the Army Technical Development Board and his services as a consultant will be available to the Department. Previous to going to Ottawa, he was professor of civil engineering at McGill University, Montreal.

Harvey E. Bushlen, M.E.I.C., has severed his connection with the McColl-Frontenac Oil Co., Ltd., at Calgary, Alta., and is at present with James, Proctor and Redfern Ltd., Toronto, Ont.

R. E. Farmer, M.E.I.C., of the Canadian Pacific Railway, has been transferred from the Laurentian Division, Que., where he was employed as division engineer to the Smiths Falls Division, Ont., where he will serve in the same capacity.

W. B. Crombie, M.E.I.C., has resigned his position as resident engineer of the Marathon Paper Mills of Canada and is now associated with the Hydro-Electric Power Commission of Ontario at Toronto, Ont.

Robert F. Shaw, M.E.I.C., who was previously shipyard manager of Foundation Maritime Limited at Pictou, N.S., is at present with Foundation Company of Canada Limited, Montreal, Que.

E. A. Phillips, M.E.I.C., has recently been appointed city engineer of Prince Rupert, B.C. He was formerly production manager of Canadian Wood Pipe & Tanks Limited, Vancouver, B.C.

E. T. Harbert, M.E.I.C., has been appointed assistant to the works manager of Canadian Ingersoll-Rand Company Limited, Sherbrooke, Que. Upon graduating from McGill University with his B.A.SC. in mechanical engineering in 1923, he joined the Canadian Ingersoll-Rand, serving first as draughtsman in the pulp and paper engineering department at Sherbrooke. He was later transferred to Montreal as sales engineer in the pulp and paper machinery division.

E. T. Harbert, M.E.I.C.

In 1929 Mr. Harbert returned to Sherbrooke, serving as draughtsman and estimator in the compressor engineering department, with supervision over field testing of compressors. Four years later he was appointed engineer in the compressor division with additional duties in pulp and paper engineering. During the war years he was appointed assistant chief engineer, and was responsible for the production engineering of the many special products built for the Armed Forces. He remained in that position until his present appointment.

John Missler, M.E.I.C., has been appointed an executive sales engineer at the head office of Darling Brothers Limited, Montreal, following completion of conversion plans for peace time manufacturing and marketing operations. A graduate of the University of Saskatchewan in civil engineering in 1934, Mr. Missler was resident engineer for Defence Industries Limited, Montreal, on construction, maintenance, and plant engineering work.

Kenneth H. J. Clarke, M.E.I.C., formerly special assistant to the deputy member for Canada, Combined Production and Resources Board, Washington, D.C., has now returned to the International Nickel Co. of Canada, Limited, at Toronto, Ont., as assistant manager of Canadian sales.

R. Melville Smith, M.E.I.C., who has been Deputy Minister of Highways of Ontario for fifteen years, has accepted the position of president of The Canada Culvert Company Limited, with head office at Toronto, Ont.

Born near Kingston, Ont., he graduated in civil engineering from Queen's University in 1914. On graduation he joined the Ontario Department of Public Works until the formation of a separate Highways Department in 1917, when he compiled reports on existing roads which led to the establishment of the Provincial Highway System. In 1925 he became its chief engineer and two years later was named Deputy Minister.

Under Mr. Smith's direction, the province has constructed and maintained a network of trunk highways and secondary roads. Outstanding among these has been the Queen Elizabeth Way from Toronto to Fort Erie, Ont. He has also contributed to the adoption of the Highway Improvement Act and the Highway Traffic Act. Mr. Smith played an important part in the development of northern Ontario, opening up an extensive agricultural and mining area through a network of modern highways. This work culminated in 1942 in the last link of an all-Canadian highway from coast to coast—of which 1400 miles lies within Ontario.

When the Alaska Highway project was started, the United States requested that Mr. Smith assist by supplying help on the aerial survey of the route of the highway and later in the direction of the construction of 350 miles of the main highway within Canadian territory.

In 1943 Mr. Smith was honoured by his *alma mater* in the granting of an LL.D. In 1942 he was awarded the Julian C. Smith Medal of the Institute " for achievement in the development of this Dominion ".

F. C. Mechin, M.E.I.C., has been named a director of Imperial Oil Limited. He joined Imperial Oil in 1916 and was assistant engineer during the construction of the Montreal refinery and engineer-in-charge of the construction of the Halifax refinery. He was manager of the Montreal East plant until September, 1944, when he moved to Toronto to become assistant to the president, in charge of employee relations and personnel. He has served during the war as consultant to the Government on petroleum, and director for protection of petroleum reserves.

William E. Sheets, M.E.I.C., who has been employed as designing engineer, hydraulic department, Hydro-Electric Power Commission of Ontario, is now attached to the Canada Life Assurance Company in the capacity of construction adviser at Toronto, Ont.

M. G. Saunders, M.E.I.C., of the Aluminum Company of Canada Limited, has been transferred from Arvida, Que., where he held the position of mechanical superintendent, to Kingston, Ont., where he has been made plant engineer.

F. J. McDiarmid, M.E.I.C., has joined the staff of John Inglis Co. Limited as assistant general sales manager at Toronto, Ont. He had been associated with W. E. S. Dyer, consulting engineer, Algoma Steel Corporation, Sault Ste Marie, Ont., as field engineer and assistant.

John Frisch, M.E.I.C. who has been employed as mechanical superintendent with the Marathon Paper Mills of Canada Limited, Marathon, Ont., has joined the staff of Canadian International Paper Company at Temiskaming, Que.

J. F. Bridge, M.E.I.C., formerly works manager of the Windsor Salt Plant of Canadian Industries Limited, is now employed as works manager of International Salt Company at Watkins Glen, N.Y.

Squadron Leader W. F. S. Carter, Jr.E.I.C., has returned to civilian life. He has taken the position of superintendent of the mechanical division, Continental Can Company of Canada Limited at St. Laurent, Que.

S. D. Levine, Jr.E.I.C., has joined the staff of the Linde Air Products Co., ceramic plant, in Tonawanda, N.Y., as technical adviser. He was previously technical foreman with Metals Disintegrating Company, Inc., at Elizabeth, N.J.

O. Nelson Mann, Jr.E.I.C., who was formerly employed at the Verdun Works of Defence Industries Limited has recently joined the staff of J. D. Woods and Gordon Limited, management consultants, at Toronto, Ont.

Marcel L. Papineau, Jr.E.I.C., who has been released from the R.C.A.F., is now with the Quebec Bureau of Mines at Noranda, Que. Before his enlistment in 1941 he was on the staff of Noranda Mines Limited at Noranda.

J. L. Strachan, Jr.E.I.C., of Defence Industries Limited, has been transferred from Montreal, Que., to the Petawawa Works, Chalk River, Ont.

Harrison H. Heisler, Jr.E.I.C., formerly a lieutenant in the R.C.N.V.R., has joined the staff of the Socony-Vacuum Oil Company Inc., at New York, N.Y., in the capacity of petroleum engineer. Before enlisting in the Navy, Mr. Heisler was associated with the Petroleum and Natural Gas Conservation Board, Black Diamond, Alta.

F. S. Idenden, Jr.E.I.C., has joined the Caribbean Petroleum Company at Maracaibo, Venezuela, in the capacity of mechanical engineer. Mr. Idenden was formerly in charge of the purchasing department of the Demarara Bauxite Company Limited at Mackenzie, British Guiana.

J. B. Sweeney, Jr.E.I.C., was released from the R.C.A.F. in July. He has returned to his former employers, Consolidated Paper Corporation Limited, at Grand'Mère, Que., where he is at present acting as assistant to the division engineer.

H. L. Lexier, Jr.E.I.C, has resigned his position as research engineer at the Physical Metallurgy Research Laboratories, Ottawa, Ont., and has returned to Regina, Sask., where he is now employed as manager and plant superintendent of the Queen City Cleaners and Launderers.

R. Fraser MacKenzie, S.E.I.C., recently graduated from the University of New Brunswick with the degree of B.Sc. in civil engineering, is at present employed as an instrumentman with the Campbellton Division of Canadian National Railways.

Squadron Leader Leonard Thomlinson, S.E.I C., has been released from the R.C.A.F. and is at present in the engineering department of Babcock-Wilcox and Goldie-McCulloch Limited at Galt, Ont.

G. Raymond Woolfrey, S.E.I.C., who graduated this year from the Nova Scotia Technical College with the degree of B.Eng. (Elec.) is now employed by the Canadian General Electric Company in Toronto, Ont.

G. B. MacCoy, S.E.I.C., who has been serving with the Canadian Army overseas, has been released from active service and is now employed by the Shawinigan Chemicals Limited, Shawinigan Falls, Que., in the capacity of junior engineer.

Paul Lavallée, S.E.I.C., has joined the staff of the Aluminum Company of Canada at Shawinigan Falls, Que. Mr. Lavallée graduated from Laval University this year with the degree of B.Sc.A. (Elec.)

Obituaries

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

Dr. Henry Girdlestone Acres, M.E.I.C., designer of the Chippawa-Queenston power development of the Ontario Hydro-Electric Power Commission and the Shipshaw power development, died in Toronto, Ont., on September 4th, 1945. Born in Paris, Ont., on May 1st, 1880, he received his preliminary education there and in 1903 graduated from the University of Toronto. In 1916 the University conferred on him the degree of mechanical and electrical engineer and in 1924 a doctorate of science.

In 1903 Dr. Acres began his association with power development with the Canadian Niagara Power Company and shortly after joined the staff of the Hydro-Electric Power Commission of Ontario, becoming their chief hydraulic engineer in 1911. While holding this position he gained fame as the builder of the Queenston-Chippawa development, whose magnitude as an engineering enterprise was regarded as the greatest on the continent with the exception of the Panama Canal. Dr. Acres was a trusted technical expert of Sir Adam Beck. During the twelve years he was with the Commission he was responsible for the design and construction of eighteen of their power plants and for the operation of twenty-five installations with a total capacity of over a million horsepower. In 1924 he began his private consulting practice with headquarters at Niagara Falls, while retaining his connection with the Hydro in a consultative capacity. His sphere of activity was widened and he advised on work in

Dr. H. G. Acres, M.E.I.C.

New Brunswick, Alberta, Saskatchewan, Newfoundland, India and South America. He designed the Shand Dam and was chief engineer of the Grand River conservation scheme, in Ontario. He was consulting engineer, supervising the construction of the Shipshaw power development in Quebec under utmost secrecy until it opened in November, 1942, to speed the output of aluminum for aeroplane production for the United Nations.

In 1942 the Julian C. Smith Medal of the Institute was conferred upon Dr. Acres, as an eminent engineer who had contributed much to give Canada her present prominence as a source of power.

Dr. Acres joined the Institute as a Member in 1915. He is a past vice-president of the Institute.

Major George Alleyne Browne, M.E.I.C., died on August 16th, 1945, in Ottawa, Ont., after an illness of several months. Born at Deseronto, Ont., on April 30th, 1887, he moved to Montreal at an early age and received his engineering education there.

He joined the engineering staff of the Canadian Pacific Railway and shortly after was transferred to the Pacific coast region. From 1915 until 1917 he was with the Royal Canadian Engineers, Second Tunnelling Company, C.E.F., and served in France. On being discharged, Major Browne became resident superintendent, engineering branch of the Military Hospital Commission, following which he was made western district superintendent of the engineering branch of the Military Hospitals Commission-Invalided Soldiers' Commission, which was later changed to the Department of Soldiers' Civil Re-establishment.

Major Browne joined the Institute as a Student in 1908, transferring to Associate Member in 1920. He became a Member in 1940.

News of the Branches

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

OTTAWA BRANCH

C. G. Biesenthal, M.E.I.C - *Secretary-Treasurer*
R. C. Purser, M.E.I.C. - - *Branch News Editor*

The Ottawa branch was favoured with a visit from the Institute president, E. P. Fetherstonhaugh, dean of engineering and architecture of the University of Manitoba, who spoke at a noon luncheon on September 13th at the Chateau Laurier. The dean was introduced by Norman Marr, chairman of the Ottawa branch, and thanked by Dr. Charles Camsell, a graduate of long standing of the University of Manitoba.

Special guests were members of the Royal Engineers, Col. V. C. Steer-Webster, O.B.E., Lt.-Col. C. W. Glover and Capt. F. H. Greatrex, in charge of the Mulberry exhibit being held at the Chateau at the time. Dr. L. Austin Wright of Montreal, general secretary of the Institute, accompanied the president.

Dean Fetherstonhaugh's address dealt with **Engineering Education**, a theme which has been the subject of previous addresses given by him before other branches of the Institute. " Engineering in Canada in the immediate future will be determined by the character and training of those now in the universities and those about to enter who are returning from the armed services ", he said. More and more educationalists are giving thought to the fact that character in young men has just as much to do with their success in after life as their academic education. For this reason serious consideration is being given to courses of study apart from the purely technical. They know that in many spheres the engineer will be faced with questions relating to public welfare, business organization, personnel and labour relations, the necessity of meeting the public, and they will have to be ready to do their share of public speaking, of writing fluently, and in general of dealing closely with the public.

As a training in such relations they should be given some grounding in what are known as the humanities. But the solution is not readily apparent. To enlarge the courses by lengthening them in any way would work a particular hardship to those who, on account of war services, are already late in entering university and are anxious to begin their life's work with the least possible delay. It is hoped that the regular four-year engineering course can be maintained, but that time can be found for more non-technical studies in line with the new idea.

Certain essentials must always be kept in mind in an engineering education, the president felt, such as a sound knowledge of mathematics, and an understanding of general engineering subjects. Perhaps, he thought, some subjects directly related to specialized studies could give way in part at least to more of the humanities; or it might be feasible to arrange a series of introductory lectures which would be worth while in this regard. The balancing up of a proper curriculum to take care of the new trend is something to which a great deal of attention will be given in the immediate future, concluded Dean Fetherstonhaugh.

QUEBEC BRANCH

Leo Roy, M.E.I.C. - - - *Secretary-Treasurer*
Roger Desjardins, Jr.E.I.C. - *Branch News Editor*

The annual golf tournament of the Quebec Branch was held on Monday, September 10th at the Royal Quebec Golf Club. The programme for the day included:

1) A tournament of 18 holes for the E.I.C. cup—won by E. Roy, after a keen competition from E. Gohier, last year's cup holder. The winner and runner-up had to play four holes in order to decide the holder of the cup. Leo Roy, secretary-treasurer of the Branch won the prize for 1st net. Numerous prizes were presented by engineering firms.

2) A 9 hole tournament for beginners won by M. Ostiguy.

3) A tournament of 9 holes for the ladies won by Mrs. H. F. Hyndman.

4) A putting contest for ladies won by Mrs. A. E. Paré.

In the evening a dinner was served at the chalet at Boischatel followed by a dance. Ninety members and ladies helped to make this 5th annual golf tournament a success.

PRESIDENTIAL VISIT TO OTTAWA

Head table, left to right: Dr. C. J. Mackenzie, Col. V. C. Steer-Webster, President E. P. Fetherstonhaugh, Norman Marr, Chas. Camsell.

Right to left: K. M. Cameron, Lt.-Col. C. W. Glover, Chas. Camsell, Norman Marr.

Right to left: Commander E. Robertson, Lt. Commander R. E. Jess.

VANCOUVER BRANCH

P. B. Stroyan, m.e.i.c. - *Branch News Editor*

On September the 10th a most interesting meeting was held in the Hotel Vancouver, under the joint sponsorship of the American Institute of Electrical Engineers, The Engineering Institute of Canada, the Association of Professional Engineers and the Engineering Bureau of the Vancouver Board of Trade. About two hundred members of the various organizations heard Mr. S. R. Weston speak on **The Programme of the British Columbia Power Commission.** Mr. Weston, as the first chairman of the newly appointed Power Commission, spoke in his official capacity and dealt very deftly with a subject which has been brought to the forefront in this province, and one which, by its very nature, might conceivably have political implications.

The speaker explained that the Commission is so constituted as to be outside the realm of political influence and assured his listeners that, contrary perhaps to opinion in some quarters, it was not the intention of the Commission to construct hydro-electric plants in out of the way places in order to furnish energy to non-existent customers.

Mr. Weston outlined the history of the circumstances leading up to the formation of the British Columbia Power Commission. In 1938 the Public Utilities was constituted in order to regulate the privately-owned utilities and its first big undertaking was an enquiry into the operation of the British Columbia Electric Railway and its subsidiaries. Later on the subject of rural electrification assumed important proportions and in 1943 the Provincial Government appointed a Rural Electrification Committee, which eventually led, in April 1945, to the setting up of the British Columbia Power Commission.

The speaker explained that the chief object of the Power Commission at present was to gradually take over the sixty odd separate companies, generating and selling domestic power throughout the province, commencing naturally with the smaller plants, both hydro and diesel. It explained that no attempt would be made to interfere with plants in the interior of the province.

Mr. Weston explained the procedure laid down in acquiring privately owned plants, commencing with an independent valuation of plant and equipment, with the right of appeal by either party if the valuation is deemed unfair.

The advantages of public ownership of the means of generating and transmitting energy was enumerated, chief among them being the reduction of interest payments on capital expenditures made with government funds borrowed at low interest, and the elimination of Federal taxes, both of which would result in lower rates to the consumer. There was no satisfactory explanation given as to whether or not this obvious loss to the Dominion treasury was an actual saving to the consumer in the long run or merely a momentary shifting of the load which would adjust itself later by taxation in some different form.

The speaker made it clear that the Power Commission was expected to pay its own way, and that each power district would have to be self-supporting, although it would only be natural that the sparsely populated districts would have to receive a subsidy in one form or another in order that the unit of energy might be kept low enough to make its use practical. There were in the act certain provisions whereby this could be done, one of which made it possible for the government to make a grant of a proportion of the original cost of installations.

By comparison with communities served by the Ontario Hydro the speaker was able to make his major point that public ownership of the power sources would result in a decrease in the unit cost of electricity and then gradually in an increase in the per capita consumption by expanding the uses of power to cover many phases of services such as lighting, cooking, heating and the operation of appliances to make life more pleasant for the consumer.

Thus, by the mass production of electrical energy and its consequent low unit cost, the lot of the country dweller could be so improved as to make conditions more nearly comparable to those in the urban districts.

Discussion followed as to the immediate plans of the Commission as well as on the many intricate problems involved in the set-up and administration of such a diversified organization. Mr. Weston was warmly thanked for his skilful handling of the subject and for his lucid explanation of a matter of great public interest.

WINNIPEG BRANCH

A. T. McCormick, M.E.I.C. - *Secretary-Treasurer*
V. W. Dick, M.E.I.C. - - - *Branch News Editor*

The first of the 1945-46 joint meetings of the Winnipeg Branch of the Institute and the Manitoba Association of Professional Engineers was held on Thursday September 20th in the form of a dinner meeting at the St. Regis Hotel, with C. P. Haltalin, chairman of the Winnipeg Branch, presiding.

After an enjoyable dinner, D. M. Stephens, Deputy Minister of Mines and Natural Resources of Manitoba, introduced the speaker of the evening, Mr. John Deutch of the Winnipeg Free Press, who gave an extremely interesting and informative address on **The Role of Private and Public Investment in a Full Employment Economy.**

The speaker stated that full employment was necessary if post-war aims were to be achieved, but pointed out that the history of business had always shown a continuous cycle of booms and depressions, and then traced the economic theories considered to affect these cycles. He pointed out that there was one factor common to all these theories, which was the role of capital investment on business conditions and therefore on employment levels. In times of prosperity, these levels increased rapidly, but with declining prosperity there was a sharp downturn in investments.

Mr. Deutch defined investment as production of goods not consumed, such as houses, machines, inventories or stocks of goods, etc. These investments are made out of savings and at any time savings equal the total of new investments. The direct effect of these investments is to increase employment, and indirectly to save by increasing assets. By trying to increase savings at the same time that investments are falling off, these savings are wasted, since purchasing power is withdrawn from the economic system causing unemployment, and the savings are used up on deficits and unemployment doles, etc., tending to make the economy run down, which produces a special effect, causing less investments, more savings wasted, less employment, and so on.

The speaker pointed out that there were important factors affecting the level of private investments, the export market being one of them. In Canada the economic system was more complicated than, for instance, in the United States which were 95 per cent self sufficient, whereas Canada's economy was influenced by foreign conditions to a great extent. In 1928, the total gross investments in Canada were 1,300 million; in 1933, 145 million; in 1939, 935 million. These extreme fluctuations were largely caused by the condition of the export market, since the largest construction projects are directly connected with these markets, such as railways, newsprint, mining, etc. Periods of greatest prosperity have been in years of enormous expansion in industries connected with exports, and the post-war period of prosperity will depend greatly on the prosperity of these export industries.

Another factor affecting the level of private investment is the nature and level of taxation. Most investments are long term undertakings and if there is a danger of taxes rising sufficiently to consume the profits, these investments will not be made. If private industry is to invest freely, excess profit taxes must be removed, and corporation taxes reduced.

Development of new industries, processes, methods and markets by research facilities is another factor. The development of the automobile in 1920 is an outstanding example of this factor, causing great expansion in factories, new industries, roads, etc. The development of radio, electric appliances, etc. are other outstanding examples. Research during the war years should produce large numbers of developments, such as television, F.M. radio, aeroplanes, plastics, etc.

The opening of virgin natural resources is a factor, the classical example being the opening up of the West. Another was the development of the North country in the 1920's, and so on. The proposals to the Dominion-Provincial Conference recognized the importance of these factors affecting investments and a number of them were included.

One proposal was that export markets be expanded, and that credits be advanced to countries needing financial assistance at this time, in order to buy Canadian goods. Another proposal suggests the use of research and special surveys to develop and conserve the natural resources of the country.

A further proposal deals with social security and its effect on maintaining the level of consumption, and its effect on industry by stabilizing the purchasing power of the lower income bracket groups, as well as promoting the welfare of the country as a whole. Also, the cost of borrowing is to be kept down by a cheap money policy. The Industrial Development Bank will enable individuals to get capital at low rates of interest for sound propositions that could not very well use the usual way of selling stocks, bonds, etc.

Finally, taxes—income, corporation, succession, etc. —should be left to the Dominion, so that one body would have control of the level and nature of these taxes, so that a policy could be laid down well in advance, to encourage the greatest amount of investment possible.

The speaker pointed out that with all these proposals there will still be fluctuations in the business cycles, and the Dominion proposals also include a system of timing public works by holding back wherever possible public works projects during boom times, and to assist the provinces and municipalities in the completion of these projects during depression periods. This would tend to counteract the fluctuations in private investments and have a stabilizing effect on industry.

To do this it is proposed to assist the provinces and municipalities by paying 50 per cent of the advance planning costs, and later to contribute 20 per cent of the construction cost as an employment measure when constructed according to the timing schedule. In this way the provinces and municipalities would be assisted in financing useful projects, and employment would be provided when necessary to counteract unemployment in private industry.

A long and interesting discussion period followed, those taking part being M. A. Lyons, G. R. Fanset, J. Dryborough, C. V. Antenbring, H. L. Briggs, D. A. McCuaig, W. D. Hurst and A. R. Goddard. The discussion period was brought to a close by Prof. N. M. Hall, who moved a hearty vote of thanks to the speaker for an interesting and informative address.

Library Notes

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

ERRATUM

As a result of a typographical error, the first paragraph was dropped from the excellent review of the book **"Engineering Preview"** contributed by S. R. Banks, and appearing in the Library Notes of the September *Journal*.

The review begins with the following paragraph: "The conception of this book is both novel and significant, and arises from the authors' realization of the growing importance of guiding the young person into a career that suits his natural gifts and in which he is therefore likely to be a useful and contented individual.

"To this end the book sets out to give the student a broad idea of the basic sciences upon which the complex and constantly-expanding art of engineering has its foundation. . . ."

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

High-Pressure Die Casting; a Design Guide for Engineers:
H. L. "Red" Harvill and Paul R. Jordon. Vernon, Calif., H. L. Red Harvill Manufacturing Co., 1945. 7¼ x 10¼ in., 130 pp., illus.

PROCEEDINGS, TRANSACTIONS, REPORTS, ETC.

Association of Professional Engineers of Saskatchewan:
Membership list, 1945.

Canadian Institute of Mining and Metallurgy and the Mining Society of Nova Scotia:
Transactions, v 47, 1944.

Engineering Society of Detroit:
Membership Directory, 1945.

Hydro-Electric Power Commission of Ontario:
Annual Report, 37th, 1944.

Institution of Water Engineers:
Transactions, v 49, 1944.

National Harbours Board:
Annual Report, 1944.

Power Corporation of Canada, Ltd.:
Annual Report, 1945.

TECHNICAL BULLETINS, ETC.

American Society for Testing Materials:

Preprints—1945:

No. 5—Report of Committee A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys. No. 6—Report of Committee B-1 on Copper and Copper-Alloy Wires for Electrical Conductors. No. 7—Report of Committee B-2 on Non-Ferrous Metals and Alloys. No. 8—Report of Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys. No. 9—Report of Committee B-4 on Electrical-Heating, Electrical-Resistance, and Electric-Furnace Alloys. No. 10—Report of Committee B-5 on Copper and Copper Alloys, Cast and Wrought. No. 11—Report of Committee B-6 on Die-Cast Metals and Alloys. No. 12—Report of Committee B-7 on Light Metals and Alloys, Cast and Wrought. No. 13—Report of Committee B-8 on Electrodeposited Metallic Coatings. No. 20—Report of Committee on Filler Metal. No. 34—Report of Committee C-1 on Cement. No. 35—Report of Committee C-4 on Clay Pipe. No. 36—Report of Committee C-5 on Fire Tests of Materials and Construction. No. 37—Report of Committee C-7 on Lime. No. 38—Report of Committee C-8 on Refractories. No. 51—Report of Committee D-1 on Paint, Varnish, Lacquer, and Related Products. No. 52—Report of Committee D-2 on Petroleum Products and Lubricants. No. 53—Report of Committee D-3 on Gaseous Fuels. No. 55—Report of Committee D-5 on Coal and Coke. No. 56—Report of Committee D-6 on Paper and Paper Products. No. 57—Report of Committee D-7 on Wood. No. 59—Report of Committee D-9 on Electrical Insulating Materials. No. 61—Report of Committee D-11 on Rubber and Rubber-Like Materials. No. 62—Report of Committee D-12 on Soaps and other Detergents.—No. 64—Report of Committee D-14 on Adhesives. No. 65—Report of Committee D-16 on Industrial Aromatic Hydrocarbons. No. 66—Report of Committee D-17 on Naval Stores. No. 67—Report of Committee D-18 on Soils for Engineering Purposes No. 68—Report of Committee D-19 on Water for Industrial Uses.

Standards:

Concrete and Concrete Aggregates—Prepared by A.S.T.M. Committee C-9, 1945.

Plastics—Sponsored by Committee D-20, 1945.

Tentative Specifications:

Iron and Steel Arc-Welding Electrodes (Serial Designation: A233 45 T). American Welding Society, 1945.

Electrochemical Society:

Preprints:

88-1—What is a "Clean" Surface? by Earnest H. Lyons, Jr. 88-2—Electrolytic Reduction of Cinnamic-Acid; Effect of Substituents on the Formation of Bimolecular Product by Eric P. Goodings and Christopher L. Wilson. 88-3—An Iodine Coulometer by E. W. Beiter.

Queen's University. Department of Industrial Relations:

Bulletin No. 10—Union Security Plans; Maintenance of Membership and the Check-off. 1945.

PAMPHLETS

Agriculture and Forests of Yukon Territory:

J. Lewis Robinson. Ottawa, Bureau of Northwest Territories and Yukon Affairs. (Reprinted from the Canadian Geographical Journal, August 1945.)

Community Meets Veteran:

Saskatchewan. Department of Education. Study Action Outline No. 1, 1945.

Hydrocarbon Reactions in the Presence of Cracking Catalysts:

Chicago, Universal Oil Products Company. (Reprinted from Journal of The American Chemical Society, v 61, 1939, c 66, 1944.)

Industrial Safety To-morrow:

Chicago, National Safety Council, n.d.

Land Use Possibilities in Mackenzie District, N.W.T.:

J. Lewis Robinson. Ottawa, Bureau of Northwest Territories and Yukon Affairs. (Reprinted from Canadian Geographical Journal, July, 1945.)

Physical Geography of the Canadian Eastern Arctic:

Ottawa, King's Printer, 1945. (Reprinted from Canada Year Book, 1945.)

Principles of System Relaying:

N.Y., Edison Electric Institute, Electrical Equipment Committee 1945. (Publication No. M-3.)

Round-Table Discussion on Organization of Industrial Waters:

N.Y., American Society for Testing Materials. (Reprinted from American Society for Testing Materials, Proceedings, v 44, 1944.)

Symposium on Analytical Colorimetry and Photometry:

N.Y., American Society for Testing Materials (Reprinted from American Society for Testing Materials, Proceedings, v 44, 1944.)

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

ELECTRICAL DRAFTING; Applied to Circuits and Wiring

D. Walter Van Gieson. N.Y. McGraw Hill, Toronto, Embassy 1945. 5¼ x 8¼ in., 144 pp., illus., $1.90 Canadian Funds.

This textbook was designed to aid the engineer or draftsman whose work is with electric circuit design and detail. In a series of discussions, the author starts with the schematic circuit diagram and develops the detailed wiring plan for several typical cases. Instructions for checking the wiring plan are also included.

The book presents modern, standard methods of electric drafting which are employed in the manufacturing company, research laboratory, power plant, the railroad, the shipyard, and the aircraft factory. It assumes that the reader has an elementary knowledge of the electric circuit.

ANALYSIS OF DRILL-JIG DESIGN

J. I. Karash. N.Y. McGraw-Hill Book Co., Inc., New York; Toronto, Embassy, 1944. 5¼ x 8¼ in. 333 pp., illus., $4.20 Canadian Funds.

Presents an analytical, factual, systematic approach to the problems of tool design, using drill jigs as a specific case study and outlining fundamental principles that apply in varied degree to all tool design problems. The process of design is analyzed into a clear-cut procedure, stressing the essential decisions, their proper sequence, and basis of fact for arriving at decisions. Specific examples are presented.

Contents: I, Outline of Design Practice. II, Gathering Information. III, Analysis of Drilling Operations. IV, Division-of-work Decision. V, Machine Decision. VI, Princ ples of Locating. VII, Clamping. VIII, Secondary-Operations Jig Feature. IX, Positioning Features. X, Chip Control. XI, Principles of Interchangeability. XII, Justification.

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 ON CEMENT (with Related Information)

Prepared by A.S.T.M. Committee C-1 on Cement; Specifications, Chemical Analysis, Physical Tests; Dec. 1944. American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, 1945. 169 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $1.50.

Specifications are given for natural, masonry and portland cements, also for air-entraining cement for pavements. Standard methods of chemical analysis are included as well as methods for a variety of physical tests. A selected list of references on cement, a supplementary annual of cement testing and other items of interest are appended.

BIBLIOGRAPHY ON SOIL MECHANICS 1940-1944 (N.R.C. No. 1291)

By R. Ruedy National Research Council of Canada, Ottawa, Canada, May 1945. 34 pp., mimeographed, 10¾ x 8½ in., paper, 25c.

More than two hundred references to articles in the technical literature from 1940 to 1944 are included in this publication. The arrangement is alphabetical by author only. A detailed classification of the field of soil mechanics as understood at the present time is included in the introduction.

INTERNATIONAL ASSOCIATION FOR BRIDGE AND STRUCTURAL ENGINEERING. Mémoires, Abhandlungen Publications

Vol. 7, 1943/44, published by the International Association for Bridge and Structural Engineering, Swiss Federal Institute of Technology, Zürich, and for sale at Gebr. Leemann & Co., Stockerstrasse 64, Zürich, 1944. 385 pp., illus., diagrs., charts, tables, 9½ x 7 in., paper, apply.

Of the eighteen papers presented in this publication, 12 are in German, five in French, and only one in English. As in previous volumes, the titles, captions of the figures, and summaries of the papers are given in three languages. The subject matter of the papers is varied within the field and demonstrates contemporary theory and practice except for one noteworthy report. The first paper is a reprint of a recently discovered report on a bridge project by L. Navier, dated 1826.

OCCUPATIONAL ACCIDENT PREVENTION

By H. H. Judson and J. M. Brown. John Wiley & Sons, New York; Chapman & Hall, London, 1944. 234 pp., tables, 8½ x 5½ in., cloth, $2.75.

The object of this reference manual is to present the fundamentals in plant operation which are important in accident prevention. For study purposes the material is arranged in three principal divisions: improvement of work procedures; improvement of plant and equipment; description of the safety organization and related activities. A list of sound-slide films available from the producers or local safety councils is appended.

PLASTICS IN PRACTICE, a Handbook of Product Applications

By J. Sasso and M. A. Brown, Jr. McGraw-Hill Book Co., New York and London, 1945. 185 pp., illus., diagrs., charts, tables, 11 x 7½ in., cloth, $4.00.

This book brings within one cover a practical review of plastics in all their successful commercial applications, providing a handy key to the essential facts on how and why plastics are used. The treatment is organized around 103 actual uses of plastics, reviewing the problems encountered in developing them and outlining the reasons for the solutions adopted. Much valuable information is given on plastics materials, properties, methods of fabricating, design and cost factors related directly to specific uses.

POWER SYSTEM STABILITY, Vol. 1, Steady State Stability

By S. B. Crary. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 291 pp., illus., diagrs., charts, tables, 8¾ x 5¼ in., cloth, $4.00.

The fundamental theory underlying maintenance of continuous electric power under normal and abnormal operating conditions is to be provided by a two-volume set of which this is the first. The present volume devotes the first five chapters to the theory required for a study of the steady state stability characteristics of a system; the last seven chapters discuss the applications of theory to system design, The theory of transient stability will be covered in the second volume.

(Continued on page 681)

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

September 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 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 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 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

BERRY—WILLIAM MURRAY, of Regina, Sask. Born at Winnipeg, Man., August 14th, 1922. Educ.: B.Sc., (Civil), Univ. of Manitoba, 1944; with Prairie Farm Rehabilitation Administration, Regina, as follows: 1941-42, (summers), rodman, 1943, (summer), instru'man., 1944 to date, jr. engr.

References: H. G. Riesen, G. L. MacKenzie, E. P. Fetherstonhaugh, W. F. Riddell, A. E. Macdonald.

CARON—MAURICE CHARLES, Lieut. (Elect.), R.C.N.V.R., of 83 St. Cyrille Blvd., Quebec, Que. Born at Tilbury, Ont., June 30th, 1922. Educ.: B.Eng., (Elect.), McGill Univ., 1944; 1940-43, (summers), railroad constrn.; and at present Elect. Officer aboard H.M.C.S. Eastview.

References: J. J. O'Neill, E. Brown, C. V. Christie, G. A. Wallace, R. DeL. French, W. P. Fogarty, J. P. Menard.

DENTON—HERSCHEL EUGENE, of Calgary, Alta. Born at Mineral Wells, Texas, Nov. 8th, 1907. Educ.: B.Sc., (Mech.), New Mexico Coll. of A. & M. Arts, (accredited E.C.P.D.), 1934; R.P.E., Alberta; 1926-34, general oilfield work relative to field development with Maljamar Oil & Gas Corp. and Ohio Oil Co. (alternate yrs. while attending Univ.); 1934-38, with Ohio Oil Co., as follows: 1934-37, asst. field supt., Casper, Wyoming and Byron, Wyoming fields; 1937-38, field supt., Casper, Wyo., Dry Creek, Montata fields; 1938-41, prod. supt., Anglo Canadian Oil Co. Ltd., Calgary, Alta.; 1941 to date, partner in Denton & Spencer, Calgary, consultg. engrg. work; also, managing-director, General Petroleums Ltd.

References: S. G. Coultis, F. K. Beach, D. P. Goodall, W. C. Howells, J. S. Irwin, R. V. Johnson.

DUMONT—J. ALFRED, of 153 Latourelle St., Quebec, Que. Born at Levis, Que., January 19th, 1909. Educ.: Spec. scientific courses at Laval Univ., and Wallace College, 1937-42; apprenticeship, dftsman., estimator, supervisor, bldg. constrn. work with J. E. Roy, Quebec; 1942-45, with C.N.R., Levis, Que., as follows: 1942-44, rodman, dftsman., instru'man., genl. tech. work and surveying in mtce. engrg.; 1944-45, structl. and bridges designing, engrg. surveying, Quebec Department of Roads, Bridges and Structures Branch, Quebec.

References: E. Gohier, J. O. Martineau, R. Savary, J. A. Lefebvre, L. Lupien, E. Leclerc.

DYKE—FREDERICK IAN LATHAM, Elect. Lieut., R.C.N.V.R., of Calgary, Alta. Born at Calgary, Alta., Sept. 10th, 1914. Educ.: B.Sc., (Elect. Eng.), Queen's Univ., 1941; with R.C.N.V.R., as follows: 1941, enlisted as Elect. Sub. Lt., 1941-42, installn. & mtce. electrical equipment on ships responsible for checking work done by elect. artificers, 1942-43, inspecn. & mtce. anti-magnetic mining gear on naval and merchant ships, 1943-45, now Elect. Officer on H.M.C.S. Preserver, i/c mtce. all elect. equipment, c/o F.M.O., Halifax, N.S.

References: F. S. Dyke, J. H. Ross, D. M. Jemmett, J. H. Ings, D. S. Ellis.

HEDIGER—LOUIS, of Victoriaville, Que. Born at Zurich, Switzerland, July 6th, 1899. Educ.: Technical College, Winterthur, Switzerland, 1919-22; 1915-18, ap'ticeship., mechanic, Machine Tool Co., Zurich, 1918-19, motor & transformer constrn., Atelier de Construction Oerlikan, Oerlikan, Switz.; 1922-25, asst. supt., Dr. Schaufelberger, Zurich, manufact. elect. household appliances; 1925-26, O. C. Breaker specialist, Shawinigan Engrg. Co., Montreal; 1926-30, dftsman., Power Engrg. Co., Montreal; 1930-32, jr. elect. engr. & dftsman., Shawinigan Water & Power Co., Montreal; 1933-34, expert in elect. tempering & annealing, Pal Blade Co., Montreal & Plattsburg, N.Y.; 1935 to date with Shawinigan Water & Power Co., south divn., Montreal, and at present acting supt. of operation and mtce., Victoriaville, Que.

References: A. W. Peters, P. Ackerman, S. C. Hill, D. E. Ellis, F. Valiquette.

HERON—BRUCE O., of 387 Holland Ave., Ottawa, Ont. Born at Toronto, Ont., July 15th, 1904. Educ.: B.A.Sc., Univ. of Toronto, 1926; R.P.E., Ontario; 1929-30, sales engr., Riley Engrg. & Supply Co.; with Aluminum Co. of Can., Toronto, as follows: 1930-32, asst. in planning dept., 1932-40, cost estimating engr.; 1940-41, asst. inspector of mech. transport, Dept. of National Defence, Ottawa; with Inspection Bd. of U.K. & Canada, Ottawa, as follows: 1941-44, inspectg. officer of tanks, sent to England for four months course and assumed responsibility for mechanical perfection of tanks produced at Angus Shops, training and management of staffs, all metallurgical problems pertaining to vehicles, etc., and at present executive asst. to Director of Inspection Services.

References: G. Stephenson, W. L. Sheldon, A. M. Bain, R. C. Simon.

HUBBLE—CHARLES WILLIAM, of 17 High St., Cricklade, Wilts, England. Born at Winnipeg, Man., April 22nd, 1914. Educ.: B.E., (Civil), Univ. of Sask., 1935; 1935-36, drawing office work, Campbell & Gifford, consultg. engrs., London, Eng.; 1936-39, asst. civil engr., Mott, Hay & Anderson, consultg. engrs., London, Eng.; 1939 to date, with Air Ministry Works Directorate, England, as follows: 1939-40, asst. civil engr., aerodrome constrn. work, organizing, inspecn. and supervision, water supplies, sewage, concrete water tanks, runways and roads, constrn. steel hangars, allied or ancillary aerodrome, work, 1940-41, acting resident engr., same type of work, 1943, resident eng'r. same type of work, 1942-44, works liaison officer, certain West African colonies, British and foreign, interpreting R.A.F. requirements from works point of view to bodies executing work as above, also seaplane bases, and at present engaged on general works services for aerodromes as sectional officer.

References: A. L. C. Atkinson, C. J. Mackenzie, N. B. Hutcheon, A. W. Bridgewater, K. Phillips.

KENNEY—JOHN HENRY, F/O., R.C.A.F., of Edmonton, Alta. Born at Rockdale, Lancs., England, March 10th, 1902. Educ.: elect. engrg., Technological Inst. of Great Britain, 1923-28; 1928-35, apprentice, mechanics & engrg., Beaver Wood Fibre Co., Thorold, Ont.; 1936-42, chief engr., Assumption College, Windsor, Ont.; with R.C.A.F. as follows: 1942 to present, constrn. engrg., supervising heating and elect. installn., designing, with the rank of Flight Officer.

References: J. B. Clark-Keith, R. E. Potter.

LAND—HERBERT LOUIS, of St. Lambert, Que. Born at Bralanda, Sweden, June 5th, 1902. Educ.: private studies; D.S.L. commission, 1930; 1919-31, with Dept. of Interior, Ottawa, field surveys, topo. surveys; 1931 to date, with Dept. of Marine, as follows: 1931, temporary jr. engr., River St. Lawrence Ship Channel Branch, 1931-34, asst. to engr. i/c staff boat, supervising dredging operations, 1932-34, (winters), in office, part time i/c survey parties on river, 1934-36, i/c survey and inspectn. vessel C. G. S. Bellechasse, making triangulation surveys, misc. hydrographic surveys, etc., 1937, asst. engr., and at present engr., i/c staff boat, supervng. contract dredging including Montreal Harbour deepening, making estimates, constructing and maintaining weirs for regulation of water levels, metering, making test borings, triangulation surveys, misc. surveys and dredging in connection with wartime shipyards, ice-breaking.

References: J. E. St. Laurent, C. A. Price, F. S. Jones, P. Kuhring, M. Boudreau, F. H. Peters.

LAURIE—E. STUART, of Montreal, Que. Born at Montreal, Feb. 2nd, 1909. Educ.: B. Eng., (Mech.), McGill Univ., 1933; 1933, Belliss & Morcom, Birmingham, Eng., 1934, Ruston & Hornsby, Lincoln, Eng.; 1934-40, with Laurie & Lamb, Engineers, Montreal, as follows: 1934-36, mech. supvr., Eldorado Gold Mines, Great Bear Lake, N.W.T., 1936-40, sales and service engr.; 1940-45, Cdn. Active Army, Royal Canadian Artillery, 1940-43, Lieutenant, 1943-45, Captain (now retired); and at present with Laurie & Lamb, as sales and service engr.

References: A. Laurie, G. E. Newell, C. M. McKergow, L. R. Thomson.

McKEEVER—JAMES LAWRENCE, of Peterboro, Ont. Born at Edinburgh, Scotland, April 27th, 1907. Educ.: B.A.Sc. (Elect.), Univ. of British Columbia, 1930; R.P.E., Ontario; with Canadian Genl. Electric, Peterboro, Ont., as follows: 1930-31, test course, 1931-35, induction motor engrg. dept., development work on single phase & polyphase motors, 1935-37, AC and DC engrg. dept., design of synchronous and direct current machines, 1937-38, i/c industrial application and central station engrg., 1938 to date, genl. engr., head genl. engrg. dept., Peterboro, i/c industrial application, central station and transportation engrg.

References: G. R. Langley, H. R. Sills, L. D. W. Magie, B. I. Burgess, V. S. Foster.

McLEOD—CEDRIC WILLIAM, Lieut., R.C.E.M.E., C.A.O. Born at Halifax, N.S., July 16th, 1918. Educ.: B.Eng., (Mech.), Nova Scotia Tech. Coll., 1942; 1941, (summer), drafting, Imperial Oil Ltd., Imperoyal, N.S.; 1942, (summer), drafting, designing, Halifax Shipyards, Ltd.; 1943 to date, with R.C.E.M.E., as Workshop Officer.

References: M. Baker, A. E. Flynn, F. H. Sexton, D. S. Nicol, S. Ball.

PARISH—CHARLES ERNEST, Lt.-Col., C.A.C.T.R., of 680 Sherbrooke St., W., Montreal, Que. Born at Hamilton, Ont., Aug. 29th, 1906. Educ.: B.Eng., (Civil), McGill Univ., 1932; 1927, (summer), with J. J. McKay, consultg. engr., Hamilton, Ont.; 1928, (summer), Geological Survey, Dept., of Mines; 1928-31, (summers), genl. constrn. experience, C. W. Parish, genl. contractor, Montreal; 1937-40, supt., genl. constrn., J. L. E. Price & Co., Ltd., Montreal; 1940 to date, Sgn. Cmdr. & O.C., C.A.C.T.R., and to return to former position with J. L. E. Price & Co., Montreal, on October 1st.

References: J. L. E. Price, A. T. Bone, E. Brown.

RUSSELL—BRUCE HAMILTON, W/C., R.C.A.F., of Mount Hope, Ont. Born at Fort William, Ont., May 24th, 1910. Educ.: B.A.Sc., (Mech.), Univ. of Toronto, 1932; 1929, (summer), instr'man., Moss Mines Ltd.; 1930, (summer), estimator, Port Arthur Shipbuilding Co.; 1935, asst. mine surveyor, Noranda Mines; 1935-36, mine engr., Ardeen Gold Mines; 1936, mine surveyor, Lamaque Gold Mines; 1936-37, mine engr., May-Spiers Gold Mines; 1938-39, sr. dftsman., Can. Car & Foundry Co.; with R.C.A.F., as follows: 1939-41, Aircraft Development Engr.; 1941-42, Engr. Officer, 1942-44, Sr. Aircraft Development Engr., Deputy-Director of Aircraft Development; 1944 to date, Asst. Director of Aero. Engrg., and at present Staff Officer, Aero. Engrg., No. 1 Air Command.

References: K. Y. Lochhead, C. W. Crossland, J. S. Houghton, J. I. Carmichael, E. G. MacGill.

SMITH—EDWARD STANLEY, Lt. (E), R.C.N.V.R., of Abbotsinch, near Paisley, Scotland. Born at Yorkton, Sask., May 23rd, 1920. Educ.: Univ. of Sask., 1939-43; 1939-43, (summers), International Nickel Co. of Can., (2 mos.), Canada Car & Foundry, Aircraft Factory; with R.C.N.V.R., as follows: 1943-44, Marine Engr. Officer i/c machinery, on H.M.S. and H.M.C.S's., 1944 to date, Air Engr. Officer, i/c repairs to all types of aircraft, R.N.A.S.

References: N. B. Hutcheon, E. K. Phillips, R. A. Spencer, I. M. Fraser, W. E. Lovell.

SMITH—ROBERT FRANCIS ALEXANDER, of Montreal, Que. Born at Pense, Sask., March 15th, 1909. Educ.: B.Sc., (Mech.), Univ. of Sask., 1932; B.Sc., (Elect.), Univ. of Manitoba, 1933; with the C.P.R., as follows: 1929, (summer, 3 mos.), rodman, (July to Sept.), dftsman., 1930, (5 mos.), 1931, (5 mos.), geological survey of Can. Student Asst., C.P.R. and contractors; with British American Oil Co., as follows: 1934-38, field engr., Moose Jaw, Sask., 1938-40, plant engr., constrn. engr., shift supervisor, Calgary Plant, 1940-41, process engr., 1941-44, asst. mgr., 1944 to date refinery mgr., Montreal East, Que.

References: F. A. Gaby, I. M. Fraser, E. K. Phillips, E. P. Fetherstonhaugh, G. Graham, A. J. Foy, B. A. Evans, J. Missler.

SOUTHMAYD—CHARLES GOODRICH, of Toronto, Ont. Born at Chicago, Ill., October 24th, 1909. Educ.: B.A.Sc., Univ. of Toronto, 1932; R.P.E., Ontario; 1940, (summer), student course, Otis Fensom Elevator Co., Hamilton, Ont.; 1931, (summer), mech. helper, Lake Shore Mines Ltd., Kirkland Lake, Ont.; 1932-37, genl. supt. & pur. agt., responsible for purchasing, planning, scheduling, estimating, costing, etc., J. Fleury & Sons, Ltd., Aurora, Ont.; 1937 to date, with Canadian Allis Chalmers Ltd., Toronto, as follows: sales engr., responsible for sales engrg., design, establishing selling prices and direct sales work on hydraulic equipment, pumps and turbines, mining mchy.

References: C. E. Sisson, W. H. Smith, F. G. Ewens, A. W. F. McQueen, H. R. Sills, G. R. Pritchard, J. F. Roberts.

STALPORT—RUDOLPHE J., of Sherbrooke, Que. Born at Montreal, Que., Nov. 5th, 1915. Educ.: H. S. leaving cert., Mtl. Tech. Inst., 1936-40;1935-40, stock control, American Can Co.; with Canadian Ingersoll Rand Co., Ltd., as follows: 1940-42, eng. design, pulp & paper divn., 1942 to date, asst. to engr. i/c comp. divn., Sherbrooke, Que.

References: E. T. Harbert, G. M. Dick, G. M. Sutherland, R. B. Killam, D. C. Crothers.

WARKE—JAMES ALEXANDER, of Royalties, Alta. Born at Pine Lake, Alta., Sept. 16th, 1907. Educ.: Inst. Tech. & Art., Calgary, Alta., 1926-28; 1927-28, fired 9 boilers at Drumheller, obtained 1st class steam papers; 1928-29, steam engr., at New Walker Mine; 1929-37, with British American Oil, Turner Valley, Alta., as steam engr. on rotary drilling rigs; 1937 to date, with Brown, Moyer, Brown, Turner Valley, as follows: 1937-38, field foreman on constructn., 1938-44, mech. supt., and at present field supt., Box 62, Royalties, Alta.

References: R. A. Brown, S. G. Coultis, A. Higgins, S. F. McLeod, J. F. Langston, C. W. Dingham.

WEIR—ROBERT LEHIGH, of 1002 Gladstone Ave., Ottawa, Ont. Born at Brockville, Ont., June 19th, 1911. Educ.: B.Sc. (Met.), Queen's Univ., 1936; 1938-42, met. engr., Steel Co. of Canada, Hamilton, Ont.; 1942 to present, Tech. Asst. to Director of Naval Stores, R.C.N., Ottawa.

References: W. E. Brown, E. A. Goodwin, C. P. Harding.

WHEELWRIGHT—BARTON, of Montreal, Que. Born at Minneapolis, Minn., March 8th, 1888. Educ.: M.E.E., 1911, Harvard Univ.; with Canadian National Railways, as follows: 1911-12, dftsman., later instr'- man., under J. R. Ambrose, Engr., Grade Separations, Toronto, (Grand Trunk Rly.), 1912-14, block signal inspectr., 1914-15, genl. signal inspector., 1915-16, asst. signal engr., 1916-17, acting signal engr., 1917-20, engr., mtce. of way, (Grand Trunk, in New England), 1920-23, engr., accountant, (Grand Trunk Rly), 1923-27, special engr., (Canadian National Railways), 1927-36, asst. to chief engr., 1936-39, engr., mtce. of way, central region, 1939-45, regional chief engr., central region, and at present system chief engr., Montreal.

References: J. E. Armstrong, O. Holden, F. L. C. Bond, H. L. Currie, R. O. Stewart, D. G. Kilburn.

FOR TRANSFER FROM JUNIOR

BROOKS—JOSEPH WARREN, of London, Ont. Born at London, Ont., June 30th, 1917. B.Sc., (Civil), Queen's Univ., 1939; 1939, Demonstrator, civil engrg., Queen's Univ., 1940, jr. engr., Beauharnois L. H. & P. Co., 1940-41, lecturer, civil engrg., Queen's; 1941-45 structural designer, steel mill bldgs., switching structures, misc. reinforced concrete foundations & superstructures. At present, engr., on estimates, layout, design & suprvn. of mis. industrial constrn. projects, Hyatt Bros. Constrn. Co., London, Ont. (Jr. 1941.)

References: A. L. Furanna, J. H. Ings, H. E. Barnett, A. W. F. McQueen, D. S. Ellis, C. R. Young.

DIGGLE—WILLIAM MARVIN, F/L, R.C.A.F., of Halifax, N.S. Born at Saskatoon, Oct. 14th, 1917. Educ.: B.Sc., (Civil), Univ. of Sask., 1940, summer, 1938, rodman, Dept. of Highways, Sask.; summer, 1939, instrmn., P.F.R.A., Sask.; spring, 1940, instructor, summer survey camp, Univ. of Sask.; 1940-41, jr. engr., Canadian Bridge Co., Walkerville. 1942 to date, R.C.A.F., at present, Command Motor Transport Officer, Eastern Air Command H.Q., Halifax, resp. for mtce. & repair motor transport vehicles in E.A.C. (Jr. 1941.)

References: J. E. Forbes, R. C. Leslie, R. A. Spencer, N. B. Hutcheon, P. E. Adams.

McKEE—GORDON HANFORD WHITEHEAD, of London, Ont. Born at Ottawa, Ont., Nov. 30th, 1913. Educ.: B.Eng., (Chem.), McGill Univ., 1936; 1936, (summer), research & analy. chem., Shawinigan Chemicals Ltd.; 1937, (summer), chem. economist, Arthur D. Little, Inc., Chemical Engrs., Cambridge, Mass., 1939, (summer), research chem., Ontario Research Foundation; 1938-40, instructor, business administration, (mfg.), Univ. of Western, Ont.; 1940-45, (4½ yrs.), Capt. & Adjt., 1 Cdn. Survey Regt., Royal Canadian Artillery; and at present, instructor, business adm., Univ. of Western, Ontario, London. (Jr. 1940.)

References: R. DeL. French, W. D. Kirk, J. Cape, E. R. Jarmain.

PHILLIPS—FREDERICK RENE, of Montreal. Born Minatilda, Mexico, Dec. 5th, 1910. Educ.: B.Eng., McGill Univ., 1932; 1933-36, genl. contg., Rodger-Phillips Contracting Co., Vancouver; 1936-37, Northern Constrn. Co., Vancouver; 1937-39, J. S. Hewson, Montreal; with C.I.L. as follows: 1939-40, res. engr., Hamilton & Beloeil; 1940-42, mtce. engr., Hamilton; 1942-43, acid supvsr., Hamilton; 1943-44, efficiency engr., Hamilton; 1944 to date, design & project work, engrg. dept., Montreal. (Jr. 1938.)

References: J. S. Hewson, I. R. Tail, H. C. Karn, J. R. Auld, A. G. Moore

PHILLIPS—ROBERT WESTON, of Chambly Canton, Que. Born at Montreal, Sept. 21st, 1909. Educ.: B.Eng., (Mech.), 1934; June to Nov., 1935, engr. i/c structural & mech. installations, Concordia Gold Mining Co., Deloro Township, Ont.; 1936-43, sales & service, meters & controls, supervising instlln combustion control metering systems, testing & adjusting, Bailey Meter Co. Ltd., Montreal; 1943-44, Lieut. Engr., R.C.N.V.R., Fuel Combustion Dept., 8 mos. officer in charge. At present, engineer, Bailey Meter Co. Ltd., Montreal (Jr. 1938.)

References: H. J. Muir, J. D. Young, H. M. Esdaile, M. G. Saunders, A. R. Roberts, R. H. Patten.

FOR TRANSFER FROM STUDENT

ASPLIN—ALBERT GRANT, of Fort Erie North, Ont. Born at Lethbridge, Alta. Feb. 23rd, 1917. Educ.: B.Eng., McGill Univ., 1938; 1938-41, drftg., Horton Steel Works Ltd., Fort Erie; 1941-42, Design & estimation, Dominion Bridge Co., Lachine; 1942-45, in R.C.A.F., Aero. Engrg. Br., mtce. engr. at various stations in Canada. At present asst. chief drftsmn., Horton Steel Works Ltd., Fort Erie. (St. 1937.)

References: C. S. Boyd, W. R. Manock, L. C. McMurty, R. deL. French, F. B. Booz.

BEAUDRY—ROGER JOSEPH, of Ottawa, Ont. Born at Ottawa Sept. 20th, 1921. Educ.: B.Sc. (Elect.) Queen's Univ., 1944; summer, 1940, Dibblee Constrn. Co.; summer, 1941, Hydro Elec. Power Comm.; summers, 1942-43, Bell Telephone Co.; 1944-45, Fire Control Officer, R.C.N.V.R.; and at present Film Sound Mtce. and Research & Development, National Film Board, Ottawa. (St. 1944.)

References: D. S. Ellis, A. Jackson, I. N. McKay.

BOONE, WILLIAM EDWARD ROY, S/L, R.C.A.F., of Eastmoor, England. Born at Toronto, Ont., Jan. 26th, 1914. Educ.: B.Sc., (Elect.), Univ. of Man., 1941; 1941-42, (8 mos.), with Small Arms Ammunition Plant, D.I.L., drafting, machine design and plant mtce.; with R.C.A.F., as follows: 1942, (4 mos.), Mech. Adjutant, 1942, (1½ mos.), Daily Servicing Engr., 1943-44, (8 mos.), Squadron Engr. Officer, 1944, (6 mos.), Daily Servicing & Repair Inspcn. Engr., 1944-45, (2 mos.), Chief Tech. Officer on Station in Bomber Command, and at present Chief Tech. Officer & Officer i/c Ground Crew Wing, Eastmoor Station, Yorks, England. (St. 1940.)

References: E. P. Fetherstonhaugh, N. M. Hall, G. H. Herriot, F. R. Vance, A. E. Macdonald.

BROWN—JAMES ALEXANDER, Lieut. (E) (AE), R.C.N.V.R., of Port Arthur, Ont. Born at Davenport, Iowa, U.S.A., Oct. 14th, 1918. Educ.: B.Sc., (Mech.), Queen's Univ., 1944; summer, 1940, Garson Mine Co.; summer, 1941, Copper Cliff Smelting Co.; with Ford Motor Company, main engrg. office, Sept., 1941, to Sept., 1942, and from April, 1943, to Sept., 1943; since 1943, Lieut., R.C.N.V.R., and at present i/c No. 1 Maintenance Unit (Corsairs) R.N.A.S. Yeovilton. (St. 1944.)

References: D. S. Ellis, R. C. Wallace, S. D. Lask, W. D. Donnelly.

BURGESS—BASIL ARTHUR, Lieut. (E.), R.C.N.V.R., of Halifax, N.S. Born at Montreal, Que., April 23rd, 1919. Educ.: B.Eng., (Mech.), McGill Univ., 1943; 1941, (summer), apprentice toolmaker, Jenkins Valves Ltd., Montreal, Que.; 1942, (summer), mech. engr., drafting, United Shipyards Ltd., Montreal; with R.C.N.V.R., as follows: 1943-44, Sub-Lieut. (E'), boiler cleaning and genl. mach. repairs, H.M.C. Dockyard, Halifax, Watchkeeper, Senior Engr., (Asst. to Chief Engr.), and at present Chief Engineer Officer, H.M.C.S. Burlington, c/o F.M.O., Halifax, with the rank of Lieut. (E). (St. 1943.)

References: H. A. Ripley, E. H. Davis, J. A. Webster, J. E. Brett, C. M. McKergow.

CUMMING—EDWIN KEITH, Lieut. (E.), R.C.N.V.R., of Halifax, N.S. Born at Cayley, Alta., Jan. 12th, 1922. Educ.: B.Eng., McGill Univ., 1944; summer, 1941, Dom. Govt., civil aviation div., Lethbridge; summer, 1942, Aircraft Repair Ltd., Edmonton; summer, 1943, J. Gordon Turnbull, Sverdrup & Parcel, Edmonton; at present Lieut. (E.), i/c machinery of small ship. (St. 1943.)

References: R. S. L. Wilson, I. F. Morrison, R. M. Hardy, C. M. McKergow, J. A. Coote, A. R. Roberts.

DOUGLAS—LLOYD ROBERT, Captain, Cdn. Army, O.C., M.D. 2, of Peterborough, Ont. Born at Silverton, Manitoba, Aug. 4th, 1916. Educ.: B.Sc., (Elect.), Univ. of Manitoba, 1938; with Cdn. Genl. Electric Co., as follows: 1938-39, test course, 1939-40, engrg. dept., 1940, (5 mos.), head office; 1940 to date with R.C.C.S., (awaiting demob.). (St. 1938.)

References: E. P. Fetherstonhaugh, G. R. Langley, A. E. Macdonald, N. M. Hall, G. H. Herriot.

GIBSON—RONALD FRANKLIN, of 1441 Drummond St., Montreal, Que. Born at Bladworth, Sask., July 26th, 1916. Educ.: B.Sc., (Mech.), Univ. of Sask., 1944; 1941, (summer), mech. mtce., Int. Nickel Co., Frood Mine; 1942, (summer), dftg. & mtce., Imperial Oil Refinery, Regina, Sask.; 1943, (summer), carrier dept., Ford Motor Co. of Can., Windsor, Ont.; 1944, (6 mos.), engrg. dept., pumps, Can. Ingersoll Rand Co., Sherbrooke, Que.; and at present jr. engr., Montreal Engineering Co., Ltd., Montreal, Que. (St. 1943.)

References: I. M. Fraser, N. B. Hutcheon, E. T. Harbert, J. T. Farmer, J. H. McLaren.

JAMES—LOURIMER, of 108 Pacific Ave., Moncton, N.B. Born at Moncton, Jan. 19th, 1921. Educ.: B.A.Sc., Univ. of Toronto, 1945; summer, 1941, dftsmn., N.B. Elec. Power Comm.; summer, 1942, engrg. asst, E. S. Stephanson Co., St. John; summer, 1943, inspctor., Fairchild Aircraft, Montreal; summer, 1944, tool designer, Armstrong & Wood, Toronto, and Machinist, Thos. Pocklington, Toronto; May, 1945, to date, mfg. methods engr., Northern Electric Co. (St. 1942.)

References: R. Angus, G. R. Lord, H. W. McKeil.

LIVINGSTON—CHARLES BURTON, Elect. Lieut.-Cmdr. (R), R.C.N.V.R., of Toronto, Ont. Born at Toronto, Jan. 16th, 1921. Educ.: B.A.Sc., Univ. of Toronto, 1942. 1942-43, jr. research engr., Div. Mech. Engrg., National Research Council, Ottawa. May, 1943, to date, R.C.N.V.R., on Radar mtce., servicing & development in Eastern Theatre with Fleet Air Arm of Royal Navy. (St. 1942.)

References: J. H. Parkin, R. F. Leggett, E. A. Allcut, T. R. Loudon.

MAGNAN—MAURICE, of Sarnia, Ont. Born at St. Gerard Majella, Que., Jan. 15th, 1917. Educ.: B.A.Sc., Ecole Poly., 1943. Summers, 1941-42, Milton Hersey Co.; 1943 to date, engr., St. Clair Processing Corpn., Sarnia, Ont. (St. 1941.)

References: Louis Trudel E. W. Dill, Paul C. Warkentin, F. F. Dyer, E. K. Lewis, R. W. Dunlop.

McGREGOR—LESLIE STEWART, of Montreal. Born at Edinburgh, Scotland, Sept. 3, 1911. Educ.: B.Eng., (Mech.), McGill Univ., 1936; 1937-38, asst. foreman, Turcot Roundhouse, C.N.R.; 1938-39, motive power inspctor., C.N.R., Toronto; 1939-40, asst. engr., Dept. Resch. & Devlpt., C.N.R., Montreal; May, 1940, to July, 1945, Lt. Col., Can. Army overseas. At present engr. with Dept. Research & Developt., C.N.R., Montreal. (St. 1935.)

References: H. G. Thompson, W. L. Thompson, A. R. Roberts, C. M McKergow, F. Williams.

NORTON—HAROLD ARTHUR, Engr. Officer, R.C.N.V.R., of Montreal, Que. Born at Montreal, Que., March 11th, 1922. Educ.: B.Eng., (Chem.), McGill Univ., 1943; 1941, (summer), Canadian Car Munitions; 1942, (summer), Defence Industries Ltd., Nitro, Que.; with R.C.N.V.R., as follows: 1943-44, training on board H.M. Ships, Chanticler, Hart & Boadicea, & H.M.C.S Magog, and at present Engr. Officer, H.M.C.S. Royal Mount, c/o F.M.O., Halifax, N.S. (St. 1943.)

References: E. Brown, D. Hillman, J. A. Coote, C. M. McKergow, R. DeL. French.

RICHARDS—JAMES LESLIE, Lieut., R.C.E.M.E., of Ottawa, Ont. Born at Ottawa, March 27th, 1920. Educ.: B.Sc., (Elect.), Queen's Univ., 1944. 1944 to date, Lieut. in R.C.E.M.E. Telecommunications. (St. 1943.)

References: LeS. Brodie, H. P. Cadario, E. C. Mayhew.

TKACZ—WILLIAM, Lieut., (E.), R.C.N.V.R., of Fort William, Ont. Born at Fort William, Ont., Feb. 19th, 1919. Educ.: B.Sc., (Mech.), Queen's Univ., 1941; 1941-43, with Ottawa Car & Aircraft Ltd., gun divn., planning & proving of component parts Vickers machine gun, fixture, tool & gauge designing, checking drawings, and supvr., tool control dept.; 1943-44, Royal Canadian Navy, Active Service as Sub./Lt. (E.), and at present with R.C.N.V.R., Lieut. (E.), M.H.C.S. Sault Ste. Marie, c/o F.M.O., Halifax, N.S. (St. 1941.)

References: D. S. Ellis, L. T. Rutledge, R. A. Low, J. I. Carmichael, W. Korcheski.

LIBRARY NOTES *(Continued from page 678)*

TESTING MACHINE TOOLS

By G. Schlesinger. 4th ed. Machinery Publishing Co., Ltd., London & Brighton; Industrial Press, New York, 1945. 94 pp., illus., diagrs., charts, tables, 11 x 8½ in., fabrikoid, $4.00.

This book is intended to guide the machine builder in making and assembling his machines, and to provide the user with a standard of accuracy for the acceptance of a machine. The tolerances specified in the book have been widely accepted in Europe and, to a large extent, in this country. Test instructions and specifications are given covering milling and gear-cutting machines, lathes and vertical boring mills, grinding machines, drilling and horizontal boring machines, planers, shapers, slotters, punching presses and stamping machines. This edition has been revised and extended.

THEORY OF FUNCTIONS, Pt. 1, Elements of the General Theory of Analytic Functions

By K. Knopp, translated by F. Bagemihl. Dover Publications, New York, 1945. 146 pp., diagrs., tables, 7 x 4 in., cloth, $1.25.

This is the first volume of a translation of Dr. Knopp's well-known monograph on the theory of functions. It is devoted to the fundamentals of the theory of functions of a complex variable: basic concepts, integral theorems, series and the expansion of analytic functions in series, singularities. There is a brief bibliography.

THERMODYNAMIC PROPERTIES OF AIR including Polytropic Functions

By J. H. Keenan and J. Kaye. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 73 pp., diagrs., tables, 10¼ x 7¼ in., cloth, $2.25.

Thirteen modern working tables are given for the ready computation of thermodynamic processes for air and gases. Sample calculations for which these tables are useful are for heating air in a regenerator, expanding air and gases from high temperatures, etc. The tables are particularly useful for gas turbine processes. In addition to the usual thermodynamic properties, values are given for viscosity, thermal conductivity, and Prandtl number, and other useful mathematical data are included.

TOP-MANAGEMENT PLANNING, Methods Needed for Postwar Orientation of Industrial Companies

By E. H. Hempel. Harper & Brothers, New York and London, 1945. 414 pp., illus., diagrs., charts, maps, woodcuts, tables, 8¾ x 5½ in., cloth, $4.50.

Top-management planning is considered as that which evaluates and integrates all aspects of an industrial enterprise from a long range viewpoint. The basic considerations are dealt with in five sections: planning the size of an enterprise; product planning; process planning; machine planning; plant location, activity area, and plant planning. Reconversion problems present a very good example of a situation needing top-management planning.

TRACK AND TURNOUT ENGINEERING

By C. M. Kurtz. Simmons-Boardman Publishing Corp., New York, 1945. 461 pp., illus., diagrs., tables, 7½ x 4 in., cloth, $5.00.

This handbook gives design details for railroad turnouts and crossings, with mathematical treatments of track layouts and connections. Topics covered include switch points, crossings, sidings, yard layouts and track connections for all conditions. The necessary mathematical reference tables are appended.

U H F RADIO SIMPLIFIED

By M. S. Kiver. D. Van Nostrand Co., New York, 1945. 238 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $3.25.

The concepts of ultra-high frequency radio are presented as logical outgrowths of the more familiar low-frequency equipment. The opening chapter provides this transition, while the following chapters successively describe the important pieces of equipment —magnetic oscillators, wave guides, cavity resonators, antennas, measuring instruments, etc.—and explain simply the principles of the production, transmission and measuring of u.h.f. currents and waves.

WORKSHOP YEARBOOK AND PRODUCTION ENGINEERING MANUAL (1)

Edited by H. C. Town. Paul Elek (Publishers) Ltd., Africa House, Kingsway, London, W.C.2, 1945. 542 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, 30s.

Part I of this volume, which continues the series previously entitled "Machine Shop Yearbook", contains five articles on special topics. Part II presents technical information and descriptions of new equipment under fourteen headings such as: precision measuring instruments, welding, hydraulic equipment, power transmission, and the standard metal cutting processes. Part III contains some fifty long abstracts from the current technical press dealing with metals and heat treatment, particularly electrical, and with plastics and powder metallurgy.

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

CHIEF CHEMIST is required by a paper company on the west coast of Canada. Candidates should have had five years pulp and paper experience and can expect a salary of about $300. a month. Apply to Box No. 3102-V.

CHEMICAL ENGINEER is required to act as junior chemist in a pulp and paper mill in the province of Quebec. Salary would be $175. to $200. a month depending on experience. Apply to Box No. 3116-V.

CIVIL

PLANT ENGINEER is required by a power and paper company in the province of Quebec for maintenance of buildings and equipment, supervising new construction, etc. Candidates should be between 30 and 40 years old, salary would be in the neighbourhood of $350. a month. Apply to Box No. 3097-V.

TOWN MANAGER is required by a town in northern Quebec. Candidates should be bilingual, graduate engineers with considerable surveying experience. Apply to Box No. 3099-V.

PLANT MANAGER is required by a company specializing in road building materials, construction materials, etc., position will involve management and organization of a company which is being reorganized in the Eastern Townships. Preference will be given to candidates who are graduate engineers, bilingual and returned service men. Apply to Box No. 3105-V.

YOUNG GRADUATE ENGINEER (CIVIL), under 30, wanted by large general contractor. Applicant must be interested in draughting and estimating as well as in all phases of construction work and must be willing to go anywhere in Canada. This offer has an excellent future. Apply to Box No. 3121-V.

CONSTRUCTION SUPERINTENDENT, age 35-45, familiar with construction and contracting and capable of handling men, is required by a firm of contractors in Ontario. Salary would be about $300. a month. Apply to Box No. 3125-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.

SEVERAL ELECTRICAL ENGINEERS with some knowledge of civil engineering are required for public utility work in the Montreal area. Candidates should be recent graduates, bilingual and could expect a salary of about $200. a month. Apply to Box No. 3108-V.

ELECTRICAL ENGINEER with good experience in aircraft work and ability to act as leader of radio and electrical group in an engineering department in the Montreal area. Salary would be about $250. a month. Preference to qualified discharged service man. Apply to Box No. 3117-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

TWO MECHANICAL ENGINEERS with experience in plant layout and design are required by a chemical manufacturing company at Shawinigan Falls, Que. Salary $250. and upwards depending on experience. Apply to Box No. 3079-V.

DESIGN ENGINEER, mechanical preferred, age 27 to 30, and preferably returned man, is required by a firm in the Montreal area for work in connection with air conditioning. Salary would be about $200. a month. Apply to Box 3092-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.

TWO MECHANICAL ENGINEERS, graduates, one with some pulp and paper experience for plant engineer, the other as assistant engineer to look after practical maintenance of plant, are required by a pulp and paper company in India. Apply to Box No. 3112-V.

AERONAUTICAL ENGINEER is required to act as operations engineer for work on cruising control, flight procedure and analysis. This position would be in the Montreal area and would be worth about $225. Preference to qualified discharged service man. Apply to Box No. 3118-V.

METALLURGICAL

METALLURGICAL 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.

METALLURGICAL ENGINEER is required by an aircraft company in the Montreal area. Apply to Box No. 3113-V.

MISCELLANEOUS

AERONAUTICAL ENGINEER with some experience, about 30 years old, required for stress analysis work by a company in the Montreal area. Apply to Box No. 3096-V.

DRAUGHTSMAN is required for the preparation in their final form of geophysical, geological and survey plans. Candidates must be good at lettering and if possible have some knowledge of geology and surveying. This position would be with a consulting engineer in northern Quebec. Apply to Box No. 3098-V.

DRAUGHTSMAN with several years' experience, age 25 to 35, is required for the design of power and lighting in industrial plants in the Montreal area. Salary will be $200. to $300. a month depending on experience. Apply to Box No. 3114-V.

INSTRUMENT MAN familiar with electrical systems of aircraft, not necessarily a graduate engineer, is required in the Montreal area for work in connection with problems of faulty installations, etc. Salary would be $200. a month. Preference will be given to qualified discharged service man. Apply to Box No. 3120-V.

GRADUATE ENGINEER in electrical, mechanical, mining or metallurgy, English-speaking with a good command of French, is required by a firm of manufacturers of abrasives and refractories, to operate a quarry and a sand mill near Montreal. Apply to Box No. 3122-V.

SALES ENGINEER, not necessarily a graduate but with good engineering and shop experience, age 30-40 years, is required by a firm engaged in the manufacture of tools and dies in the Montreal area. Sales personality very important, starting salary would be about $50. a week. Apply to Box No. 3128-V.

ARCHITECT or graduate civil engineer, age about 25 is required in Montreal for draughting and design work in connection with new buildings for a large company. Salary would be $200. a month. Apply to Box No. 3133-V.

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

CHEMICAL

PAPER MILL FOREMAN is required by a paper company in the St. Maurice Valley to learn paper-making. Preference will be given to an ex-service man and salary will be from $225 to $300 a month. Apply to Box No. 3022-V.

CHEMICAL ENGINEER, recent graduate is required by a company in the Montreal area engaged in the manufacture of pigments and binders for production control work. Apply to Box No. 3089-V.

CIVIL

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, graduate, with land surveyor's certificate between the ages of 25 and 30 is required to work with a firm of consulting engineers and land surveyors in south-eastern Ontario with eventual prospect of partnership. Starting salary would be $200 a month. Apply to Box No. 2980-V.

CIVIL ENGINEER is required in eastern Ontario to act as transitman on railway maintenance work for a railway company. Salary is approximately $185. per month with expenses. Apply to Box No. 3036-V.

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 to act as instrumentman for a survey party in the Abitibi district. Salary would be between $175 and $200 a month. Apply to Box No. 3076-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.

MECHANICAL

MECHANICAL ENGINEER, preferably with some experience in the pulp and paper industry is required for draughting and design work with a pulp and paper company in the Lake St. John district at a salary of approximately $300. a month. Apply to Box No. 2941-V.

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 three or four years' general experience and about 25 years old, is required for general investigational work, methods improvement, etc., in a large new factory in the Montreal area. Salary will be about $225. a month. Apply to Box No. 3049-V.

SEVERAL MECHANICAL ENGINEERS are required to act as sales engineers for stokers. Some experience in boilers and stoker work desirable but not essential. Candidates should be between 25 and 35 years old and bilingual. Salary will be about $225. a month. Apply to Box No. 3044-V.

TWO ASSISTANT PROFESSORS are required by a university in western Canada, one to specialize in machine design, the other for power plant design. Also a number of demonstrators and instructors, full-time and part-time are needed. Recent graduates will be considered for full-time work or for part-time teaching and part-time post-graduate study. Apply to Box No 3050-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.

SEVERAL MECHANICAL ENGINEERS are required to act as representatives for a firm dealing in diesel and gasoline engines for industrial use. Candidates need not be graduates and should be between 25 and 30 years old. Salary would be about $250 a month. Apply to Box No. 3067-V.

SENIOR MECHANICAL DRAUGHTSMAN with considerable experience in mechanical design and detailing is required for the design of mechanism and detailing of machine parts for plant improvements. This is a temporary position at Shawinigan Falls and is worth between $200 and $275 a month. Apply to Box No. 3071-V.

MECHANICAL ENGINEER, age 25-35 years with some experience in testing metals is required to be engaged in the testing of tensile, compression, impact, fatigue and creep characteristics of certain alloys. This position would be in Kingston at a salary of between $200 and $300 a month. Apply to Box No. 3075-V.

MECHANICAL ENGINEER required as assistant engineer in meat packing firm with plants throughout Canada. Duties to consist of design and layout of steam, refrigeration, and processing equipment, and cost control work in steam and refrigeration production. Position available in Calgary at a salary of $195 to $240 per month depending on experience. Apply to Box No. 3082-V.

TWO MECHANICAL ENGINEERS are required as mechanical superintendents with leading meat packing plant. Duties consist of supervising the operation of steam, refrigeration and electrical equipment, and the maintenance of all buildings and equipment. Positions available at Vancouver and Regina. Would prefer men with experience on similar work, under 40 years of age. Salary $220 to $280 a month depending on experience. Apply to Box No. 3083-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

MISCELLANEOUS

SALES ENGINEERS are required by a company in Montreal engaged in the manufacture of insulating materials. Candidates must have technical education and preferably some plant operating and sales experience. Conversational knowledge of French desirable. Salary would be $200-$225 a month plus commissions. Apply to Box No. 2993-V.

SEVERAL ENGINEERING DRAUGHTSMEN, preferably ex-service men, 30 years or younger, are required by a Canadian newsprint manufacturer. Salary would be between $160 and $250 a month depending on experience. Apply to Box No. 3023-V.

SALES ENGINEER, graduate engineer, preferably but not necessarily, in electrical, is required by a firm engaged in the manufacture of all outdoor electrical equipment. Candidates should be about 25 years old, bilingual, and preference will be given to discharged service man. Salary will be between $150. and $225. depending on experience and the location will be in the Toronto area. Apply to Box No. 3046-V.

RECENT GRADUATE in engineering is required to act as technical assistant for a firm of patent attorneys engaged in important industrial work in the Montreal area. Apply to Box No. 3061-V.

SEVERAL SALESMEN are required in the Toronto area for parts for automobiles, trucks, buses, etc. Candidates need not be graduate engineers but should be between 25 and 30 years old and should have business and sales ability. Salary would be in the neighbourhood of $250. Apply to Box No. 3066-V.

SEVERAL DRAUGHTSMEN not necessarily graduate engineers, bilingual, are required for mapping in the province of Quebec. Apply to Box No. 3074-V.

FIELD SERVICE ENGINEER, qualified to give instruction in shops or clinics on automotive electrical systems, carburetion systems and fuel systems for the service department of a firm interested in covering the province of Quebec and the Maritime provinces. Should be fluently bilingual. Apply to Box No. 3077-V.

TWO CIVIL OR MECHANICAL GRADUATES, preferably with some experience in plant layout work are required by a firm in eastern Quebec. Work would involve draughting at first with complete control of a process after some months. Candidates should be 25-35 years old and salary would be about $200 a month. Apply to Box No. 3079-V.

ASSISTANT ENGINEER is required in the engineering and design division of a company manufacturing road machinery, paper mills and wood-working machinery. Candidates should have experience in foundry, forge and machine shop and structural steel and should be between 30 and 40 years old with ability to assume responsibility. Salary would be between $200 and $250 a month and the location would be in southern Ontario. Apply to Box No. 3080-V.

SEVERAL SALES ENGINEERS not necessarily graduates but with mechanical inclinations and good appearance, between the ages of 21 and 25, are required to be trained in Montreal by a firm engaged in the production of machine tools and machinery. Preference will be given to returned service men and salary would be from $150 a month up, depending on experience. Apply to Box No. 3085-V.

Situations Wanted

ELECTRICAL ENGINEER, M.E.I.C., age 38, married, B.Sc. McGill. Widespread experience on electrical mill maintenance, radio and telephone engineering. Five and a half years in the R.C.A.F. specializing on aircraft electrical work. Familiar with Harland and General Electric paper mill drives. At present expecting imminent discharge from the R.C.A.F. Interested in maintenance, development or layout design of electrical equipment. Apply to Box No. 12-W.

MECHANICAL ENGINEER, Canadian graduate, age 45, married with eighteen years experience in foundry, machine shop, structural fabrication and assembly work, seeks a responsible position in this field. Accustomed to handle executive responsibilities and with a proven ability to secure the co-operation of others. Apply to Box No. 251-W.

ELECTRICAL ENGINEER, B.Sc., McGill '31, currently holding responsible supervisory position in government war agency, available on short notice. Interested in inspection, plant engineering and management. Prefer remaining in Montreal area. Apply to Box No. 626-W.

ELECTRICAL ENGINEER, M.E.I.C., age 35, with thirteen years' experience in manufacturing electrical and mechanical products, including production supervision and management, designing, engineering, sales, purchasing, cost accounting, advertising and wage and labour problems. Available about January 1st, 1946. Apply to Box No. 816-W.

CIVIL AND MINING ENGINEER, M.E.I.C., R.P.E., age 44 married; employed by D.N.D.(N) for 3 years as maintenance and construction engineer on permanent works and buildings; experience includes eight years as chief surveyor with important mining company and ten years general engineering on construction of storage dams, hydro-electric developments, railways, roads, townsites and land surveys. Seeks a responsible position in construction or mining industry. Available on short notice under W.B.T.P. regulations. Apply to Box No. 901-W.

MECHANICAL ENGINEER, age 34, Lt. (E) R.C.N.V.R., soon to be discharged. Experience, 6 years heavy maintenance on railroads, 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 R.C.N.V.R. of which 20 months have been at sea. Thorough knowledge of machine and boiler shops, able to plan and to handle men. Registered with W.B.T.P. Apply to Box No. 2456-W.

EXECUTIVE ENGINEER available. Graduate in mining, M.E.I.C., age 36, married. With experience in engineering sales work, road and paving construction, miscellaneous engineering, building construction, plant engineering; responsible for steam and water plants, water and sewage works, electrical power distribution, maintenance of plant buildings and miscellaneous process equipment. Experience in cost accounting, designing and estimating. Administrative experience as assistant manager of munitions plant. Capable of handling men. Apply to Box No. 2508-W.

CIVIL ENGINEER, Jr.E.I.C., age 25, B.Sc. Alberta, 3 years on highway location and construction, 2 years building construction and maintenance; desires contacts in construction or industrial field for employment in near future. At present engineer works officer, R.C.E., Location immaterial. Apply to Box No. 2521-W.

MECHANICAL ENGINEER, M.E.I.C., R.P.E. (Que.) and B.Sc. McGill, married, 45 years old. Experienced in plant design, layout and construction. Seventeen years in construction, owning own business and five years in munitions manufacture. Experienced business manager and executive. Available now for responsible position. Apply to Box No. 2526-W.

GRADUATE MECHANICAL ENGINEER, S.E.I.C., R.P.E.(Ont.), graduate of Nova Scotia Technical College, 1943, age 25, married. Two years as Sub Lieut. and Lieut.(E) R.C.N.V.R., engineer draughtsman and estimator on complete naval fuelling base layouts, tankage, piping, pumping stations and wharf facilities. Also six months of heating and plumbing layouts for naval buildings. Honorably discharged, March, 1945. Presently employed as heating engineer with contracting firm installing heating and plumbing facilities in fifteen story hospital building. Desire permanent connection with opportunities for advancement. Available under W.B.T.P. regulations. Location immaterial if living accommodations available. Apply to Box No. 2532-W.

GRADUATE CIVIL ENGINEER, Jr.E.I.C., in B.C., 30 years of age, married, experience mostly mechanical; 5½ years oil refinery construction, maintenance, laboratory and processing, one year aircraft inspection. Past three years as assistant engineer with firm engaged in the manufacture of naval instruments, in charge of fine pitch gear manufacture and plastic molding. Apply to Box No. 2533-W.

CHEMICAL ENGINEER, age 28, single, desires position with responsibility and good future prospects. Applicant has one year's experience in research and development, 3 years in production and administration, and is a qualified instructor of job instruction training, job methods training, safety and job evaluation. At present engaged as area supervisor of production. Immediately available under W.B.T.P. regulations. Apply to Box No. 2534-W.

MECHANICAL ENGINEER, B.A.Sc., Tor., age 27, married, some experience in aircraft shop engineering including stress analysis and more extensively in shop engineering, estimating and production layout work with large electrical manufacturing company. Applicant has good organizing ability and could best serve in a production engineering capacity preferably with a small manufacturing company in Ontario. Apply to Box No. 2535-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., age 28, with 5 years' experience in large plant operation, design and construction, and executive training and experience in safety engineering, desires position with industrial concern in construction, building supplies, plant operation or safety engineering. Applicant will be available October 1st, 1945, or thereafter. Apply to Box No. 2536-W

GRADUATE METALLURGICAL ENGINEER, age 25, available immediately. Canadian, bilingual, desires employment in Montreal or vicinity. Willing to travel occasionally. Experience in light metals and gray cast iron metallurgy, foundry practice. Has held responsible position in charge of production industrial engineering, buying, supervisory experience. Would consider employment with industrial consultants or with progressive engineering organizations or in sales. Apply to Box No. 2554-W.

ENGINEERS

Applications for several junior engineer positions will be received by a Canadian engineering firm. The company can place suitable young men with operating electric utilities in Central and South America, for initial periods of two or three years. Continuity of service and promotions dependent upon showing. Returned servicemen preferred, who have completed an electrical or mechanical engineering course and have their degree. Opportunities also available for young engineers with diesel operating experience. Address applications in writing to Box No. 3123-V.

Electrical Engineers Wanted

Progressive electrical engineers are required by The Manitoba Power Commission for a rapidly expanding rural electrification programme. Applicants should be under 40 years of age with at least 5 years' experience in the electrical utility field on transmission, substation and distribution system design, estimating construction and/or operating. Application should state age, education, experience and salary expected, and be accompanied by references as to ability and character and recent photograph addressed to Manitoba Power Commission, 602 Canada Building, Winnipeg, Man.

PLANT ENGINEER

Graduate with pulp and paper mill experience to supervise maintenance of kraft pulp mill. Familiar with preventative maintenance and skill in dealing with labour problems.

SENIOR ENGINEERS

Two graduates of mechanical or civil with pulp and paper mill experience to act as project engineers in engineering department of sulphite pulp mill. Candidates must have considerable ability to follow through projects from study and design to construction and operation. Salary according to experience and results.

Apply to Box No. 3093-V

STEAM ENGINEER

Montreal Engineering Company, Limited, 244 St. James Street, Montreal, has an opening for a good man to take charge of a 10,000 KVA steam-electric generating station in South America. Applicant should have a college degree in electrical or mechanical engineering, and have had generating station experience, including the operation and maintenance of boilers, turbo-generators and accessory and allied equipment. Apply in writing, stating education, experience, giving reference, age, family status, health record, and attaching a small recent photograph of self. Ex-service personnel will receive special consideration.

Water Power Engineer

Wanted by the Government of Newfoundland, a qualified Water Power Engineer with fifteen to twenty years' experience in water power development, to proceed to Newfoundland for the purpose of making a complete survey of the water power resources of the country. The successful applicant will be required to enter into a contract with the Newfoundland Government for a period of two years. Salary and living allowance amount to $8,000.00 per annum.

For further information apply to the Commissioner for Natural Resources, St. John's, Newfoundland.

INDUSTRIAL ENGINEER

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Excellent opportunity, with one of the largest Canadian companies for a man with the following qualifications. Record of satisfactory performance in position of responsibility in plant operations. General knowledge of production control, time study, job evaluation and industrial relations. Age between 25 and 40 years. Special consideration will be given applicants who have had wire mill and cold heading experience. Complete detailed information should be sent to Box No. 3127-V.

Industrial News

Industrial development—new products—changes in personnel—special events—trade literature

SALES MANAGER

The appointment of L. F. A. Mitchell as manager of sales, Canadian Westinghouse Co. Ltd., was recently announced by H. A. Cooch, vice-president.

Mr. Mitchell has been connected with sales activities at the head office of the company since 1931 and also served in various capacities in the industrial sales department of the Westinghouse Electric Corporation at East Pittsburgh from 1937 until his return to Canada in 1944 as assistant to vice-president, a position he has held until this latest assignment.

WESTERN REPRESENTATIVE

K. O. Lee Company, Aberdeen, South Dakota, manufacturers of machine tools and automotive maintenance equipment, have announced the appointment of J. E. Cartmel, 2658 West 3rd Avenue, Vancouver, B.C., to the position of factory representative for Western Canada, servicing all accounts from Winnipeg westward to the coast.

SALES ENGINEER

According to a recent announcement Paul H. Meincke, B.Sc., has been appointed sales engineer at the head office of Darling Brothers Limited, Montreal, following completion of conversion plans for peacetime manufacturing and marketing operation.

A graduate of the University of Manitoba in electrical engineering, Mr. Meincke was formerly with the Canadian Pratt & Whitney Aircraft Co. Ltd., Montreal, as chief engineer for sales, service and overhaul of P. and W. aircraft engines, Hamilton standard propellers, pumps and aircraft accessories.

BURLINGTON APPOINTMENT

H. J. Stambaugh, president, Burlington Steel Co. Ltd., has announced the appointment of M. S. Sutherland as controller. Graduating from R.M.C., Kingston, in 1929, Mr. Sutherland joined the staff of Price, Waterhouse & Co., Toronto, where he served until obtaining leave of absence to join the R.C.A.F. in June 1940, acting in an administrative capacity until March 1945.

M. S. Sutherland

Francis M. Paul

TREMCO APPOINTMENT

The Tremco Manufacturing Company of Cleveland, Ohio, and Toronto, Canada, has announced the appointment of Francis M. Paul as advertising manager.

Mr. Paul's broad technical and business experience includes management of sales, advertising, and public relations with the Air-Maze Corporation and executive sales promotion activities for the F. C. Russell Company.

PHILIP CAREY APPOINTMENTS

Sale of Robert T. Purves Limited to the Philip Carey Co. Ltd. was recently announced by Mr. Robert T. Purves. Preceding the formation of Purves Limited in 1927, the asbestos and insulation business, which the company specialized in, was operated as a direct branch of the Carey Company.

Mr. Purves was an employee of the Carey branch before forming his own company. He is to devote a portion of his time as special Carey representative, but the actual management will be assumed by Henry T. Pritchard who has been vice-president, and will now also serve as general manager of Purves.

Mr. Pritchard, a native of Brantford, Ont., and a graduate of the University of Toronto, has had a wide and varied experience in Canadian industry. He joined the Carey Company in 1939.

Robert T. Purves Limited will be operated as a wholly owned subsidiary of the Philip Carey Co. Ltd., whose headquarters are in Lennoxville, P.Q. It is planned to expand and enlarge all facilities of the organization which will operate as an industrial insulation contractor throughout Canada and will also act as distributors for the complete Carey line of Canadian-produced Carey products.

E. W. Smith, vice-president in charge of sales, has recently announced the appointment of Eric W. Hammarstrom to be sales manager of the Philip Carey Co. Ltd.

Mr. Hammarstrom, who was formerly assistant to Mr. Smith, brings to his new position many years of experience in the roofing and insulation field. During the War, he spent a year and a half in Washington with the War Production Board as Deputy Chief of the Non-Metallic Section of the Building Materials Division.

ADVERTISING MANAGER

Ernest Harris has been appointed advertising manager of Canadian Liquid Air Co. Ltd., Montreal, and editor of The Welding Review, the company's technical publication.

Born in Liverpool, England, Mr. Harris came to Canada in 1926 and joined the Victor Talking Machine Company in Montreal. In 1928 he went to the De Forest Crosley Radio Company, later becoming local service manager at Montreal. When De Forest merged with Rogers Majestic several years later, he joined the new company remaining there until 1936, when he became assistant to the late James S. Moss in the advertising department of Canadian Liquid Air.

Until his present appointment he served as assistant advertising manager and associate editor of The Welding Review.

REJOINS C.G.E.

Major Jack Duncan, M.B.E., has rejoined the industrial division of the apparatus department, Canadian General Electric Co. Ltd., after five years as a signals officer with the Canadian Army. He will be engaged in industrial applications of motors and controls.

Major Duncan took part in the Italian campaign as a staff officer, Chief Signals Officer's Branch at 1st Canadian Corps Headquarters, Eighth Army. The award of the M.B.E. was, in Major Duncan's words, "for doing a little extra work". His work consisted in the main of formulating policy, providing equipment and dealing with personnel problems all relative to army communications. He returned to Canada in October, 1944, to take a post with the directing staff of the Canadian War Staff Course at the Royal Military College at Kingston. He joined the staff of the apparatus department at C.G.E. head office in 1929.

Major Jack Duncan, M.B.E.

RESEARCH CENTER

Plans for a new research center in which greatly expanded and accelerated development work will be carried on in the fields of building materials, insulations and other products urgently needed for postwar housing and industrial operations, were recently announced by Lewis H. Brown, president of Johns-Manville Corporation.

The Research Center, the first unit of which is already under construction, is planned ultimately to be a group of six buildings located on a 93-acre plot of land near Bound Brook, N.J., and across the Raritan River from the large Johns-Manville plant at Manville, N.J.

Dr. C. F. Rassweiler, vice-president and director of research, in describing the new Research Center, said that the first unit, in addition to research laboratory facilities, will also "provide 10 experimental factories under one roof. Projects initiated in the research laboratory may thus be carried clear through their development and pilot-plant production stages. This is expected to speed up the development of new and improved materials for building and for industrial uses, since new products will be more nearly ready for commercial manufacture when they emerge from the Research Center".

C.G.E. APPOINTMENT

J. S. Keenan, manager of the supply department, Canadian General Electric Co. Ltd., has announced the appointment of W. Smallwood as manager of the air conditioning division of the supply department. The division is responsible for oil and gas furnaces and commercial refrigerating, cooking, and ventilating equipment.

Mr. Smallwood joined the company in 1936 after previous association with several refrigeration companies in Canada and a period spent as operating engineer with the Southern California Edison Company. In 1937 Mr. Smallwood joined the sales engineering staff of C.G.E. and in May, 1941, entered the supply department as a refrigeration specialist.

For the past seven years he has, in addition, been teaching night extension technical school courses on commercial refrigeration and air conditioning in Toronto.

W. Smallwood

H. W. Wilson

SHELL VICE-PRESIDENT

Shell Oil Co. of Canada Limited has announced the appointment of H. W. Wilson as vice-president.

Before the war, Mr. Wilson was general sales manager for Shell in Canada. At war's outbreak, he was in England and was loaned to the Canadian Department of Munitions and Supply, to head up the English operations of its textile division. Now those duties have ended, Mr. Wilson has returned to Canada as vice-president of Shell Oil.

DOMINION RUBBER PLANS

The sod turning ceremony at the site of the tire factory of the Dominion Rubber Company in Kitchener, Ont., took place on September 5th, launching the first step in the expansion construction programme of new additions to the main buildings.

Additions to the main tire factory building will include a building of approximately 100,000 square feet in area, of four storeys in height with basement, to be used principally for warehousing facilities, thus replacing storage space which was devoted in wartime to the installation of more rubber processing equipment to meet emergency production requirements.

Other installations include a new steam plant and circulating systems, equipped with a modern coal handling system to unload two cars of coal an hour to feed the boilers. The purpose of the two additions is to develop enclosed railway and trucking shipping facilities in the first place, and to provide means for the development of absolute temperature and pressure control, essential to the production of high quality tires and tubes, which are produced at the plant.

An additional outlay will be made by the company on an extensive programme of rehabilitation of existing plant facilities. It is expected to enter new markets as a result of some of this expansion, and production lines are to be set up with a view to supplying the farm trade in tractor and implement tires.

QUEBEC REPRESENTATIVES

According to a recent announcement, Medusa Products of Canada Limited have appointed David C. Orrock & Company as their representative in the province of Quebec. David C. Orrock is president.

ELECTRIC WELDED TUBING

Standard Tube Co. Ltd., Woodstock, Ont., have for distribution a 32-page booklet, prepared by Formed Steel Tube Institute of Cleveland, Ohio, for engineers and product designers. It is profusely illustrated, discusses the manufacture, fabrication, peacetime and wartime uses of electric welded tubing. Photographs and sketches showing how tubing can be bent and assembled are given. Lists regarding applications and specifications, and also of standard sizes are presented. Also given are examples of pressure applications for every type of industry.

FRIGIDAIRE EXPANSION

Plans are completed and construction begun at Leaside for the post-war expansion of Frigidaire Products of Canada Limited involving a three-time increase in production facilities and an expenditure of approximately $2,000,000, according to a recent announcement by W. C. Cannon, president and general manager.

Electric refrigerators, home freezers and electric ranges, on which production was discontinued to make way for war work in 1942, will start rolling out of the plant within a month. In addition to these goods for home use, there will be a broad line of units for commercial market.

PIPING POINTERS

Crane Limited, Montreal, have issued a 32-page illustrated manual which is the direct outgrowth of a complete series of "Piping Pointers", developed and distributed in leaflet and wall chart form during the war years. It is intended to constitute a reference volume for use in connection with the rehabilitation of piping systems which, in many cases, due to the exigencies of war, have been subject to neglect. A second practical but equally important purpose is to provide educational data for use in the training of juniors, apprentices, and others in proper piping practice. Topics include standard piping terms; service rating marks; types of end connections; valve design and operation; handling of valves, fittings and pipe; make-up of joints, and other subjects of value to both the experienced pipefitter and trainee.

David C. Orrock

THE ENGINEERING JOURNAL

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"To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."

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COVER PICTURE

The means of extending human vision by the use of radar waves is being applied to civilian air transportation by Trans-Canada Air Lines. An experimental radar station has been installed at T.C.A.'s operational headquarters at Stevenson Field, Winnipeg, Man. The cover picture shows a rotating semi-cylindrical shaped antenna which sends out radio waves and then catches the returning echo. (*Photograph courtesy Trans-Canada Air Lines.*)

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RADAR AS AN AID TO AIR NAVIGATION AND METEOROLOGY

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Canadian Army Operational Research Group

Since V-J Day certain security restrictions have been lifted, with the result that secret wartime developments have been publicized to a limited extent. As the general public has idealized radar as a sort of magical instrument it has recently been the subject of numerous articles, so that by now most people know that radar operates on the echo principle.

If someone standing some distance from a cliff shouts, then measures the time interval which elapses before he hears the echo, he can easily compute the distance to the cliff if the speed of sound in air is known. Radar uses this same idea but, instead of sound waves, substitutes radio waves of exceedingly high frequency.

A radar transmitter differs from the usual radio transmitter in that it sends out radio waves in " bursts " or as they are usually called, " pulses ". After each pulse the transmitter cuts off, and the receiver listens for the " echo " to come back from the target. The time required for the pulse to be reflected by the target and return to the radar is measured electrically and allows the range to be calculated. As radio waves travel with the velocity of light (186,000 miles per second), radar must be able to accurately measure micro-seconds of time.

Although everyone now knows that radar can detect aircraft and surface vessels, many do not realize the importance of other targets. On certain frequencies, rain and snow give excellent echoes. This fact has long been known but it has been regarded as a nuisance rather than of practicable use. Since the summer of 1944, however, research carried out by the Canadian Army Operational Research Group at Ottawa has shown that these echoes from storms can be most useful to the meteorologists and to the civil airlines. It may be that one of radar's most important peace-time uses will be this very development.

Before discussing these storm echoes in detail, a typical high powered radar set will be described to give a better picture of what a radar operator sees. The set chosen is the MEW (micro-wave early warning) which is a recent development of the National Research Council of Canada. This was one of the sets used by the Army Research personnel in their investigation of storm echoes.

A radar detects the presence and position of objects by means of reflected waves. The radiated waves are focused into a narrow beam by means of a directional antenna and the beam is swept through 360 degrees in the horizontal plane by rotation of the antenna. The objects may be aircraft, hills, precipitation, barns, houses, etc., whatever provides the radar beam with a target as it sweeps. The radio waves are transmitted in sharp bursts or " pulses " at a rate of approximately 288 per second. Each pulse is of extremely short duration, one micro-second. Between pulses there is a period of about 3,472 micro-seconds during which the radar receiver may detect the echoes reflected by the target or targets. (See Fig. 1).

When the radar detects a target, its position is usually indicated in three co-ordinates, slant range, elevation and azimuth. In the case of MEW, only two are recorded: slant range and azimuth. Our radio beam is 1 deg. in horizontal and 4 deg. in vertical extent (at half power) and our aerial array is adjusted so that the direction of maximum intensity is 1 deg. above the horizon.

The slant range is the distance from the radar to the target.

The azimuth is the horizontal angle, at the radar, between the target and true North.

With the radio beam directed at 1 deg. above the horizontal, slant range is essentially equal to ground range.

The radar measures the range of the target by timing the interval between transmission of a pulse and reception of the echoes. Since radio waves travel at a velocity of 186,000 miles per second or 0.186 miles per micro-second, for each micro-second in the interval the wave travels 0.186 miles round trip from radar to target and back, accordingly the distance to the target is 0.093 miles for each micro-second in the interval. If the measured interval between transmission and reception is 10 micro-seconds the range is 0.93 miles. The maximum interval which can be accommodated is the interval between transmitted pulses or about 3,472 micro-seconds. Consequently the maximum distance at which a target can be detected is approximately

$$.093 \times 3{,}472 = 323 \text{ miles.}$$

Our equipment (MEW) has an effective maximum range of 160 miles. Sufficient power in the transmitter and sensitivity in the receiver are provided to produce discernible echoes from large size targets up to that distance. The reflection of radar signals is a highly inefficient process. The power radiated in the pulse disperses with the square of the distance as it travels to the target and the power in the echo disperses at the same rate as it returns to the radar. It follows that the power available to actuate the receiver falls off as the fourth power of the distance to a target. This means that the transmitted power may be increased by a factor of 16 (12 db) to double the effective range of a radar viewing a given target

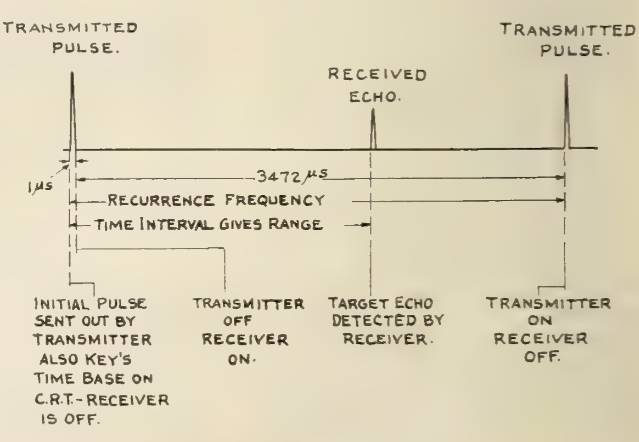


Fig. 1

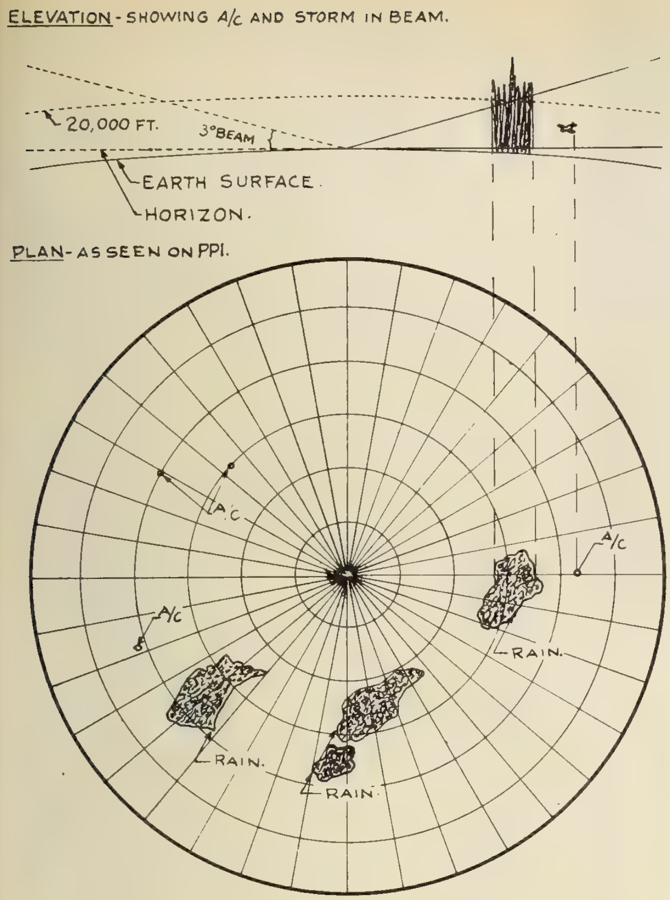


Fig. 2

(aircraft) in empty space. This is not quite so in the case of precipitation which may fill the radio beam 100 per cent; then the power available to actuate the receiver falls off only as the square of the distance to the target and return. Thus precipitation of a certain intensity clearly visible at 20 miles may be completely invisible at 80 miles.

This reasoning points to the necessity of employing the highest possible power in the transmitter and greatest possible sensitivity in the receiver. The peak output of the MEW is 300 kilowatts.

The peak output is calculated as follows:

$$P_k = \frac{\text{Average Input Power}}{(\text{Pulse width})\ (\text{pulse recurrence frequency})} \times \text{Efficiency} = \frac{200}{\frac{1}{10^6} \times 288} \times \frac{45}{100} = 300 \text{ kw.}$$

The receiver is similar to the superheterodyne circuits used in commercial radios. A crystal is used as a first detector since it operates more efficiently than vacuum tubes at the extremely high frequencies employed. Wide band (5 to 10 Mc/s) intermediate frequency and video amplifiers are used in order to pass the sharp front of the pulse with a minimum of distortion.

The signal from the receiver is applied to a PPI (Plan Position Indicator) display tube, a large cathode ray tube with a long persistence screen. A radial sweep is used, starting at the centre of the tube to that where the echo appears. The sweep is rotated about its starting point in synchronism with the rotation of the antenna, so that at any time the direction of the sweep corresponds to the direction of the radiated beam; that is, the azimuth of the target. To facilitate reading the tube, reference markers are electrically inscribed on the screen. Concentric range circles are marked at intervals of 20 miles, and radial azimuth markers are spaced at 10 deg. intervals (see Fig 2). Any target can be easily located by means of the grid thus formed.

Aircraft appear as small bright dots, precipitation as large " fuzzy " patches, permanent echoes, such as nearby hills, etc., as patches of bright echoes. Aircraft and echoes from precipitation are easily differentiated from permanent echoes (hills, etc.) because of their movement.

The PPI display gives the following information about an echo, the first two directly, the third by computation.

(1) Position, by range in miles and bearing in degrees
(2) Size and undistorted shape
(3) Velocity of the echoes, both speed and direction by change of position with time
(4) Intensity of an echo to a limited extent.

Altitude and vertical extent of the target can be obtained by using an equipment similar to MEW but

(Courtesy National Research Council)
Fig. 3—Tower Assembly; side view.

which is especially designed to give height together with range and bearing of the target.

Signal Stages.

The signal is produced, radiated, received, mixed, amplified, and detected in the equipment housed in the tower (see Fig. 3). The modulator (F rack) contains a rotary spark gap which discharges a Guillemin line 288 times per second. The resultant pulses which are negative are applied through a pulse transformer to a magnetron in G rack. The R.F. pulses from the magnetron are fed to the antenna via a rectangular wave guide which is choke coupled to the antenna. The antenna is a linear, end-fed slotted wave-guide, which floodlights a cylindrical mirror of parabolic cross-section. The parabola acts as a focussing reflector and beams R.F. energy into space.

Signals are picked up by the same antenna and fed to the crystal mixer stage via a T.R. switch. To the mixer stage is also fed the output of the local oscillator, a McNally velocity modulated tube. The resultant heterodyne signal at an intermediate frequency is fed from the crystal to the I.F. amplifier. After nine stages of I.F. amplification, the second detector passes the video signal, via a cathode follower from E.1 chassis to the monitor scope (E.2 chassis). In the E.2 chassis, the video signal is amplified and applied to the " Y " plate of the CRT. From there it passes through the slip ring assembly, junction box and A.6 distribution panel, to the video distribution chassis, A.5. The signal passes through a high frequency filter and limiter to dual cathode followers for distribution to B.4 and C.4. From B.4 and C.4 the signal is applied to the grids of the " B " and " PPI " scopes respectively, for intensity modulation. The information supplied by MEW is read from two long-persistence c.r. tube indicators. Both tubes employ electro-magnetic deflection and intensity modulation. The PPI tube presents the usual plan position indication, in which the beam is swept from the centre of the tube to its edge, the resultant time base being rotated about its starting point in synchronism with the rotation of the array. The time base is rotated electrically by means of a stationary coil placed about the neck of the PPI tube. The coil itself is star wound and is conected to the similar star-wound secondary of the PPI selsyn. Thus, the currents induced in the PPI selsyn secondary as a result of the rotation of the selsyn primary, (in turn mechanically linked to the aerial array) are reproduced about the neck of the PPI tube. The resultant magnetic fields which vary directly with the position of the array, produce the rotational movement of the PPI time base. This system eliminates all the disadvantages of a mechanical system, since the only running part here is the selsyn rotor.

Applications of Micro-wave Radar to Storm Detection

Stormy Weather, a Canadian Army Operational Research project became operative in June, 1944. It is a study of the principles and applications of radar storm detection, that is, radar echoes from precipitation. Radar echoes originating in clouds or storms have been observed for some years all over the world. These have been analyzed and correlated with the necessary meteorological data. The method provides a well-defined picture at any time of regions of heavy rain up to a service radius of 100 miles and in the case of echoes originating in heavy showers up to a maximum range of 160 miles. In summer such regions are closely correlated to cumulo-nimbus activity. The distribution of such activity over a large area can thus be followed, and aircraft (their positions revealed by the same equipment) guided accordingly.

Precipitation reflects enough of the radar beam to make its position known. It does not weaken the beam very much however. Thus, the beam sees not only the outside of the storm, but sees it in depth, more like an X-ray. One storm does not mask another storm situated behind it.

The radar method has also been used to analyze precipitation in height. Cloud or fog cannot be de-

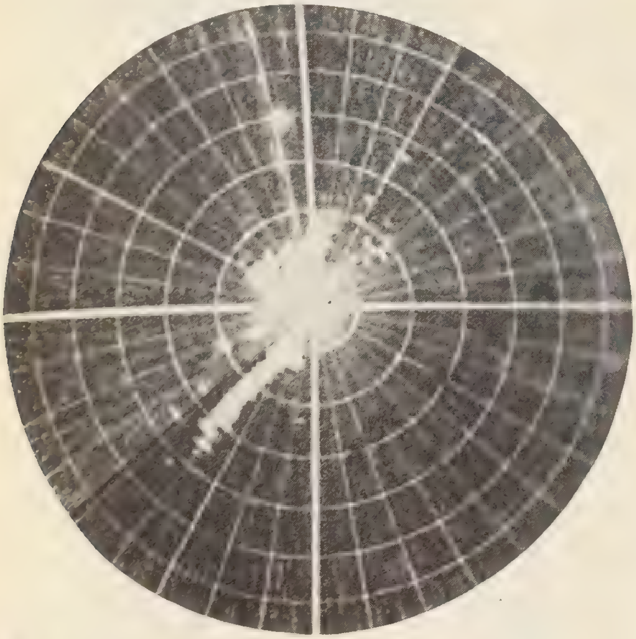


Fig. 4 Photograph of a PPI showing radar weather echoes. A line of thunderstorms moving ahead of a cold front. PPI tube centred six miles south of Ottawa.

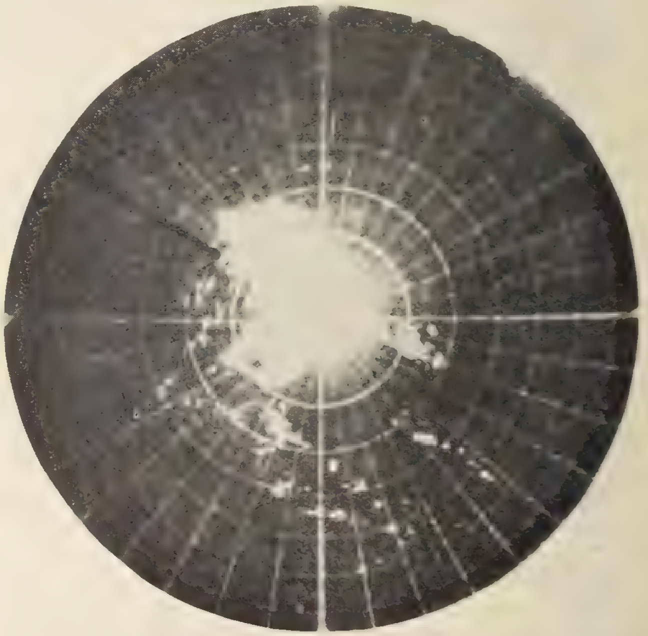


Fig. 5—Photograph of a PPI showing radar weather echoes. Wide-spread precipitation with some isolated instability showers. Weather echoes can be seen to 137 miles. PPI tube centred six miles south of Ottawa.

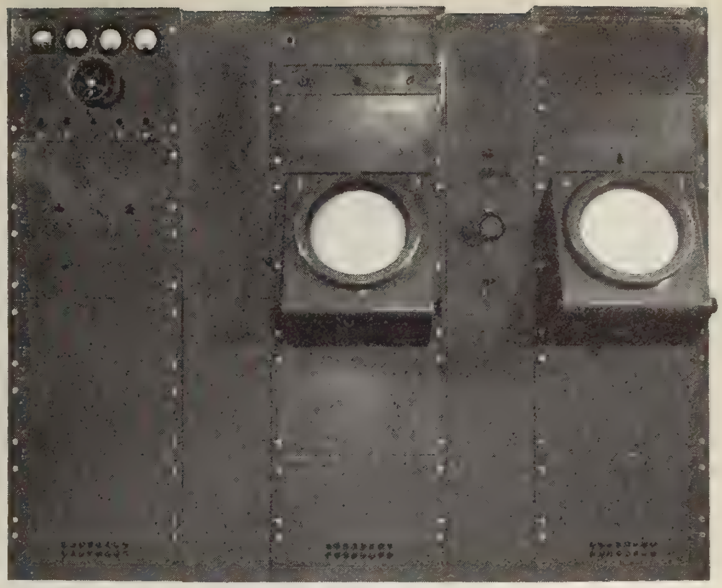
tected but precipitation in the form of rain or snow can. Cloud or fog have been detected with radar equipments operating on shorter micro-wave lengths.

Radar weather echoes furnish an instantaneous true picture of the precipitation within its service area, which therefore provides information on the moment of origin and the position of any shower which may develop (within its service radius) and promptly determines its speed and direction of motion.

An Aid to Air Navigation

For instance, let us suppose that a pilot leaving the airport is given as his latest forecast of weather conditions enroute, probabilities of rain showers and let us suppose that he is flying at night. He may, during his trip enter a very severe instability shower or thunder storm endangering his aircraft and, it goes without saying, causing great discomfort for his passengers. He has little knowledge of how extensive the storm is. Radar makes available to the meteorologist, and in turn to the pilot, information as to the exact location and extent of these showers at the moment the pilot is being briefed. This means that the pilot can determine whether or not the storm is affecting the route which he is about to fly or whether the direction of motion of the storm is such that it will intercept his route at some point in flight. If the storm is known to affect the route he is about to take he can make the necessary arrangements to fly around it, knowing from the radar information the extent of the storm. Let us assume that no storms at that moment are affecting his route and he leaves for his destination. Some time later a storm does develop on the route he has taken. The controller at the airport can immediately warn him by radio and instruct him to fly around the storm or if this is impossible, to return. At present the cases are numerous where, because of thunder storm activities in a portion of the country, commercial airlines are forced to cancel their schedules for many hours with great inconvenience to the travellers and financial loss to the airline. With radar this can be limited to a point where, providing there is visibility for the pilot to take off or land, in most cases he should be able to fly his route in relative safety. Now let us look at the procedure for aircraft flying the airways.

Undoubtedly most people know that aircraft flying by instrument (most commercial aircraft do) fly preset routes, these routes being marked electrically by radio beacons. It is the duty of the controller of a sector to authorize aircraft flying these air-lines to fly at certain set altitudes. This is done so that there will be no danger of collision. The controller at Montreal airport, for instance, is responsible for aircraft flying in all sectors from Sterling, east of Toronto, to some point near Quebec city; from Burlington, south of the border, to the Laurentides in the north. He maintains a very careful log of air traffic on these routes and instructs, by radio, aircrafts in flight. Let us assume that a flight is leaving Dorval airport for Toronto via Ottawa. The pilot files a flight plan. This flight plan will show the time of departure, the height at which he would like to fly, estimated time of arrival, etc. Usually the pilot makes this plan in conjunction with the meteorologist who advises him as to weather. He then presents this plan for approval to the air traffic controller who may approve it or recommend changes, depending on traffic conditions. The pilot having taken off maintains continuous contact with the ground by radio. Should a storm build up in some area en route the controller has no means of identifying its position unless it is reported to him by the plane or by the meteorological bureau. Canada is a vast country. Meteorological observers are very widespread. This means that the storm may have developed and have been moving along for some considerable distance before it is reported. With radar giving an instantaneous picture of such storms the controller is in a position to advise aircraft in flight of impending danger and to regulate his traffic accordingly. Furthermore should a storm be moving in towards an airport, its rate of motion and direction being indicated by radar, the controller by knowing the position of all his aircraft in flight or about to take off or land can order these aircraft to take off earlier, land sooner, or alter their schedule by so many minutes. This is quite difficult to do within minutes, with standard forecasting methods, but with radar it becomes entirely feasible. In other words, passengers waiting at the airport to depart, instead of being told that the flight is delayed for some uncertain amount of time can be informed that in so many minutes the plane will resume its travel. How much less annoying this would be than present methods.



(Courtesy National Research Council)

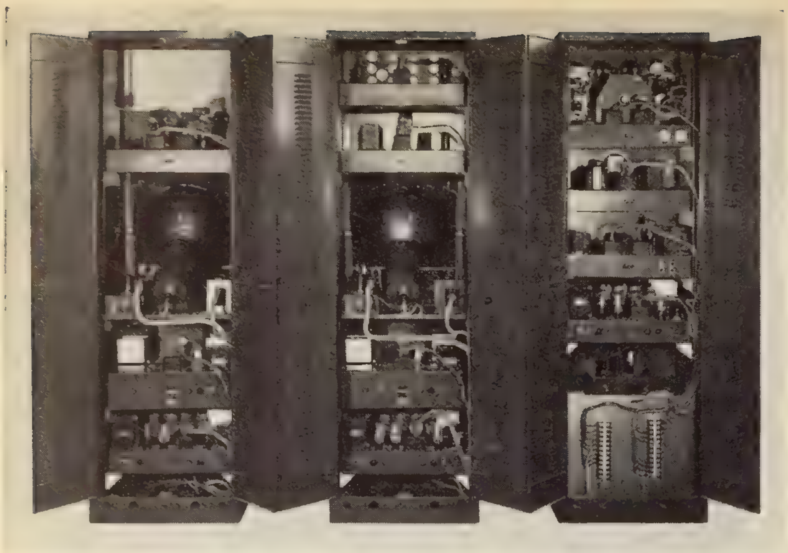
Fig. 6—Main rack assembly; front view showing PPI tubes.

Other Applications

It already has been said that all radar weather echoes furnish an instantaneous true picture of the precipitation within its service area. Some of the things to which this information can be applied are:

(a) To assist the meteorologist to locate and to find out the direction of motion of the precipitation associated with warm or cold fronts.

(b) To inform the meteorologist of the exact posi-



(*Courtesy National Research Council*)
Fig. 7—Main rack assembly; rear view showing component parts.

tions of showers within the service radius of the set.

(c) To warn air traffic controllers or airline operators of storms on or crossing their airways.

(d) To guide aircraft through or around storm centres.

(e) To warn power companies of storms crossing their lines.

(f) To warn transportation companies (bus and streetcar line operators) of storms approaching a locality, allowing these to anticipate heavier load demands.

(g) If required, to warn the public, the farmers of the path taken by violent storms.

A network of radar stations from coast to coast is feasible; if its usefulness is fully exploited its operating costs should be within reason. As the information available from radar can be useful to a large group of the population it is reasonable to feel that its implementation and operation would be government controlled. It would be quite uneconomical, in Canada at least, for any particular company to install and operate such a system for its own use, as it must be repeated that, it is only economically feasible if its full usefulness is exploited. The information available from a radar set as seen on a PPI tube cannot economically be transmitted to any great distance. A reasonably economical method of transmission of radar weather information is therefore required. The logical site for the installation of a radar equipment is at or very near an airport, it would then be feasible to install a remote PPI tube directly in the air traffic controller's and in the meteorological offices. But in the case of all other recipients of the information, it is necessary that radar weather information be transmitted by some other means in the most intelligible form possible so that it can be used with a minimum of delay.

Transmission of Radar Weather Echoes

With this in mind, Canadian Army Operational Research Group developed a method of coding, transmitting by telephone or teletype information regarding the position of storm echoes seen on the (PPI) radar tube. It can be seen that with a limited number of ellipses being transmitted a picture of all storms within an area of nearly 62,000 sq. mi. per station can be given to the recipient of the message. These messages can be transmitted by telephone or teletype. The method of coding, transmitting and decoding outlined are not just suggestions; they have formed part of a research project carried out by CAORG in co-operation with the National Research Council, the Department of Transport and the R.C.A.F. during the summer of 1945. The results of these trials showed that the information appearing on the PPI at a radar weather station could be coded, transmitted by telephone then decoded by the recipient in less than 12 minutes, giving him a workable picture of the storms affecting the area covered by the radar set. No special skill was required by the recipient to decode these messages.

Suggested Use of War Equipment

It is hoped that in the not too distant future, Canada may be blessed with a network of radar stations from coast to coast. If the cost of installation and operation of such a network should appear initially large, let us not forget that with a system such as this, Canada would have in case of any future war the finest system available in the world for aircraft detection and could by this means have available information of all aircraft flying over a large portion of its territory. It seems that this point alone is worth some financial sacrifice during peace time.

Because of the rapid advances made in the science of electronics, equipments of a radar nature become obsolete quickly; at present five years is a conservative estimate. The suggestion is therefore to use presently available surplus radar equipments, knowing these to be not specifically designed for the job on hand but capable of successful operation; as operational experience is gained, design of a more modern and suitable equipment can be undertaken by our National Research Council, eventually replacing our present radar equipments with more suitable ones. If we are to keep in time with the research carried out in other countries, we must set ourselves some objective.

This article cannot be completed without a word about the use of this system in rehabilitation of service personnel. At present the majority of all those Canadians having knowledge of radar are or were in the service. What a wonderful opportunity it would be for these people to be employed in the installation and operation of a network such as this, what a great pool of knowledge would be available in the case of any future conflict.

ANTI-MALARIA DRAINAGE IN TRINIDAD

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Condensation of a thesis submitted in compliance with the requirements for the degree of M.Sc. in civil engineering at the University of New Brunswick

The Disease and Its Incidence

Malaria is one of the greatest causes of death and, undoubtedly, the greatest single cause of economic loss throughout the tropical and sub-tropical regions of the earth. It is purely a mosquito-borne disease and it is by virtue of this, plus the fact that the mosquito life cycle includes an aquatic period, that the engineer becomes directly concerned with its control.

Malaria is transmitted only by the sting of mosquitoes of the Anopheline species. Of these there are many different kinds, the habits and characteristics of which vary considerably.

The mosquito in sucking blood from an infected person or animal takes into its stomach the malaria parasite together with the blood. There one stage of the life cycle of the parasite is completed, after which the mosquito will, upon stinging another individual, transmit the disease to him. Shortly thereafter the victim becomes a new source from which hitherto uninfected mosquitos may become infected.

Climatically, the spread of malaria is limited by the fact that a mean temperature of 60 deg. F. is needed for the development of the parasites (plasmodidae) in the mosquito. However, this condition need exist only for a small part of the year, and the disease, once contracted by man, does not decline with the onset of cold weather

Malaria once existed fairly generally over the southern part of Canada but, since 1880, it has largely disappeared from this region as well as from the Northern United States. Even in the south, there has been a recession of the disease. There is, however, a belief among malarialogists that the lowest point of this recession is already past, for the disease has reappeared recently in areas from which it had long been absent.

The increased use of air travel will probably favour the spread of infection by the transportation to new areas of mosquitos already infected as well as of persons infected. Witness the recent importation of yellow fever infected mosquitos (aedes aegypti) into Brazil from Africa.

Preliminary Planning

Malaria can be controlled by various means, of which only two are of direct interest to the engineer; they are, the naturalistic method and drainage.

Before any anti-malaria programme is begun, an entomological survey of the area in question should be made. This is somewhat outside the field of the engineer, but he has occasion to be interested in the findings. The habits and characteristics of the type or types of anophelines found are of importance, together with information as to areas which are actually receiving or breeding grounds. Many areas may appear to be ideal breeding grounds, yet not be acting as such at the time. Naturally it is usually desired to concentrate on the active areas first.

If more detailed knowledge is lacking, it is generally assumed that the local anopheline has a flight range of one mile.

In the case of the work at Point Fortin, Trinidad, on which this paper is based, the necessary surveys were made by the staff physician and an assistant employed for the purpose. Their surveys became routine and constituted a valuable check on the efficacy of the work done.

It was found that in this region there were no anophelines which preferred sunlight to shade, so clearing of all bush was indicated. This may not always be the case and the situation may be adversely affected if clearing is done unadvisedly.

The Point Fortin region being an oil bearing area, had been well mapped and large scale contour maps were available. These were valuable in planning and greatly reduced the field work necessary.

With the help of these maps, a general drainage plan was made which, while not exact, or in detail, was very useful since by reference to it, it was possible to determine the desirable invert elevations of drainage structures at any location. As new roads and streets were continually under construction, this avoided the resetting of culverts, etc., at a later date.

Similarly, spoil from other operations was used for fills where it otherwise would have been wasted, and borrowing carried out later when the anti-malaria work proper reached that region.

The area to be drained, as is shown by the map in Fig. 1, was chiefly residential. The dwellings themselves, with the exception of some native houses, were located on ground sufficiently high to drain properly, but the areas of high ground were nearly enclosed by swampy land. Drainage of the high lands chiefly involved the prevention of erosion and the filling or draining of incidental ponds.

Clearing

Clearing was considered essential in view of the habits of the type of mosquito prevalent locally, and was accomplished by a petty contract system in which the engineer offered a price for a unit of work, and the contractor accepted or rejected the offer made.

Where removal of stumps was proposed, trees were cut at waist height to allow easier stump removal by bulldozer.

Stumps were removed by bulldozer which also carried a single-drum winch. After all stumps which could be so handled were removed by the blade, the remainder were pulled by the winch, with which a set of blocks were used, particularly in removing the stumps of mora, balata, immortelle, crapaud, and cocorite trees, all of which are very tenacious.

Products of clearing were burned when possible, but some means of assisting combustion was generally necessary.

Accordingly, where the material to be burned was near enough to one of the many existing pipe lines for natural gas, a one-inch diameter line was laid and the gas used in burners. These were joined to the lines by rubber hose, and one man was able to handle several burners, shifting them as required and thus maintaining combustion in three or four piles of material for each burner used.

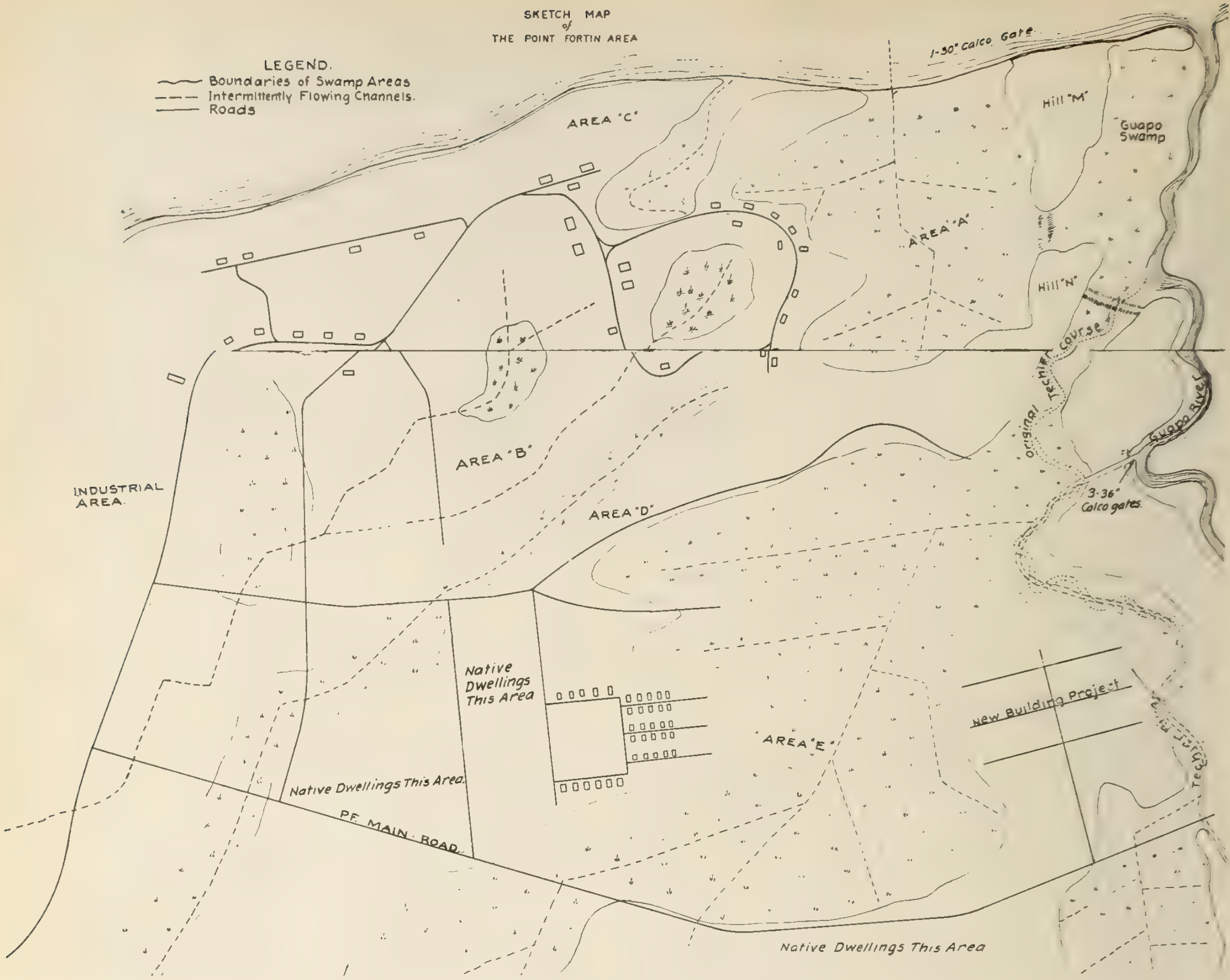

Fig. 1—General map of Point Fortin area.

The prices for clearing were based on a wage rate for labour of 14½c per hour, and cover the burning of branches, etc., but not the logs or stumps which required assistance in burning.

Pavings

The area to be drained was covered by a top-soil of very fine sandy clay while the subsoil was heavy clay. The heavy growth of vegetation prevented erosion on all slopes except in drainage channels where the scour was considerable. In consequence of this scour, paving of drains on steep slopes was required.

Several types of paving were tried. For drains having a gradient greater than five per cent, concrete was found to be the only suitable material available. It was decided to use pre-cast slabs, and a shop was set up for their manufacture.

Manufacture of Pre-cast Slabs.

A concrete floored building was used as a shop, with a mixer of 3 cu. ft. capacity. Charges for shop and mixer are not included in the costs which are given below.

Slabs were made of a 1:2:4 mix using ½ in. crushed blue limestone and a fairly clean sharp river sand with maximum particle size of ⅛ in. No reinforcing was used. Pouring was done in the afternoon and the forms removed the following morning.

Forms were made as shown in Fig. 2 of rough Douglas fir and generally were good for 150 to 180 re-uses. As indicated in the figure, only side forms were used. These were laid on a wooden decking which acted as the bottom form in all cases.

For the forming of the bottom slabs, an inverted " V " of wood was nailed to the shop floor, and battens nailed to the floor also to position the forms about the " V " piece. This formed the pilot channel.

The following cost figures on production of slabs are based on a wage rate of 15c per hour. Direct overheads are distributed on labour, and are high (about 40 per cent) due to the poor quality of labour available.

Material Prices

Lumber	$0.10	per	f.b.m.
Aggregate — limestone	3.84	"	cu. yd.
Sand	3.62	"	cu. yd.
Cement	4.50	"	bbl.

The following figures are based on the cost of these operations as of May 31, 1941:—

Total cu. ft. of slabs made	5070
Cost of materials per cu. ft. of slabs	61.21c
Cost of labour per slab	22.83c

Cost Per Slab

Size	Actual Cost	Charged to projects
24″x24″2″	63.64c	68c
15″x36″x3″	80.21	86
12″x24″x2″	43.23	55
Half-round	73.84	82

Recoveries

From the beginning of 1941, slabs have been charged to projects at a standard rate for each size, based on the actual operating costs for November and December, 1940. By this method we have over-recovered $370.00 for the first four months of 1941, the average cost of slabs having dropped from 75c to 68c.

The cost of these slabs is high but compares favourably with any other concrete work undertaken in the vicinity.

Material costs amount to $16.53 per cu. yd. of concrete. Of this $12.40 is the cost of cement and aggregates, and the remaining $4.13 includes forming and incidentals. This is obviously less than would have been required for cast-in-place construction.

Slabs were transported by truck as near to site as possible at 12c per ton mile. Handling from truck points to drains was done by hand and was paid for at the rate of 50c per 100 ft. of drain per 100 ft. of carry. This figure is based on the assumption that a man travels at 160 ft. per minute over the round trip, carrying a load one way only.

One man carries one slab at 160 ft./min. average

Round trip time: 2 x 150/160 = 1.88 min.
Slabs carried per hour, 60/1.88 = 32
Time required for job, 133/32 = 4.15 hrs.
4.15 hrs. @ 15c = 62.25 c, say 63c

Payment at the rate offered would be:

150/100 x 100/100 x 50c = 75c

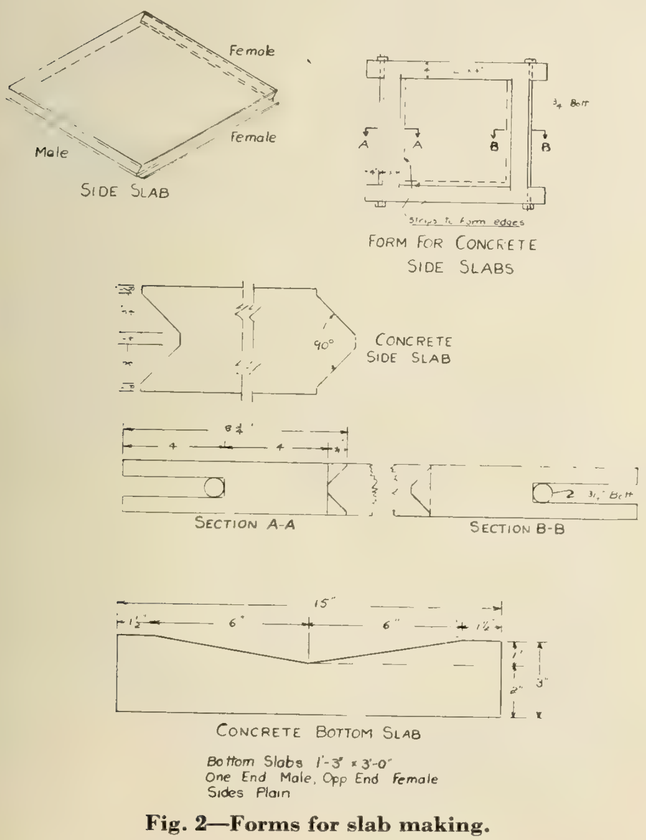

Fig. 2—Forms for slab making.

This allows the contractor 12c or 19 per cent of the actual labour cost.

Shaping and Paving of Drains

Shaping of drains prior to the setting of slabs was paid for generally at the rate of 3c per lineal ft. This was to cover trimming only, and not any improvement or correction of any magnitude. Setting slabs, cementing the joints, filling and tamping where required behind the slabs was paid for at 7c per lineal ft. or drain. This covered all the actual work of setting the slabs, and was arrived at by time studies on the operation. Fifteen per cent of labour costs was allowed as the fee for contractor.

Contractors eventually developed skilled crews to whom they paid slightly higher than normal wages while making better profits for themselves by virtue of increased production.

Templates of 2 by 4 in. lumber were made to fit the required drain sections, and were very useful in guiding the work and as a check.

Over-all Costs

As an example of the over-all costs of this type of drain, let us assume a drain 600 ft. long beginning 200 ft. from the stockpile of slabs, which in turn is two miles from the shop.

Slabs required: (Drain 15 in. wide at bottom)

15″x36″x3″	200 @ 86c	$ 172.00
24″x24″x2″	600 @ 68c	408.00
Cement	1 drum	4.50
Sand, etc.		4.00
	Total materials	$ 588.50

Weight of slabs is 49 tons approx.

Trucking	49 x 2 @ 12c	$ 11.76
Carrying	6 x 5 x 50c	15.00
Shaping	600 ft. @ 3c	18.00
Paving	600 ft. @ 7c	42.00
	Total labour	$ 86.76
	Total cost of drain	675.26

Cost per foot 675.26/600 — $1.12½

With regard to the possible performance of this type of work in regions where a different wage scale exists, it may be interesting to note the following factors:—

(a) Manufacture of slabs required: 1.52 man-hr. per slab or 2.03 man-hr. per ft. of drain.
(b) Field labour: .083 man-hr. per foot (average case).
(c) Concrete slabs total: 0.036 cu. yd. of concrete per foot.

The photograph, Fig. 3, shows a section of the first drain paved in this way.

The shallow "V" in the bottom slabs formed a pilot channel which is essential to good drainage of very small flows between storms, e.g. septic tank discharge, seepage, etc.

Slabs were easily laid to curves in line and grade, the curve shown in Fig. 3 being of about 30 ft. radius. No difficulty was found in laying even sharper curves.

Joints were left uncemented between side slabs from the top of the invert slab about 2 in. upward. This proved satisfactory as provision for seepage. It was found important to ensure that the tops of

Fig. 3—Photograph of drain paved with concrete slabs.

side slabs should be slightly lower than the earth immediately back of them; otherwise where soil was dense small pools formed there and served as breeding grounds for mosquitos.

Costs on this type of paving were high, largely due to the high cost of materials. Use of the slabs saved a large amount of forming lumber as against cast-in-place construction. Added to this is the fact that concrete could be poured under cover which is an important factor in a region where rains occur almost daily over seven months.

When drains had to be relocated due to other construction, it was found possible to salvage 90 per cent of slabs.

Other Pavings

For slopes less than five per cent, various paving types were tried. One, which is of academic interest in oil bearing regions, consisted of a layer of crushed stone covered with a layer of oil-sand and rolled. The oil sand is a natural material being a fine sand completely coated with residual asphalt from the evaporation of oil deposits. In use it was broken into small pieces, spread on the stone course and rolled by use of a hand roller.

These drains were in the form of a trough and never over 18 in. deep. Side slopes had to be kept flat to prevent slipping of the paving material. Later it was found that an improvement could be made by melting a hard commercial asphalt and pouring it over the oil sand layer. Better cohesion and more resistance to erosion resulted.

A similar paving was made by spreading and rolling the crushed rock layer and penetrating it with asphalt emulsion. Since bleeding or richness was not detrimental, asphalt was generally poured to refusal.

These types are not suitable where any chance of flooding occurs, since water running into the channel as the flood subsides tends to break the sides of the paved channel. Where laid in suitable sites however, this type is quite good for small flows. Total labour for shaping and paving these drains (after material on site) amounted to about half a man-hour per sq. yd.

In order to avoid bringing water from paved tributaries into unpaved drains at high velocities the grades of paved channels were generally flattened to a distance of 50 to 100 ft.. back from their junctions with the mains. This was frequently done by putting a " step " in the gradient of the paved channel.

Wood linings were not considered practicable since the action of termites and rot in that region is too rapid.

Erosion and Sedimentation

The bulk of expenditure on the Point Fortin project was occasioned by paving of drains on steep gradients, but the prevention of erosion was a minor reason for the work done. More important was the reduction of the sedimentation in the adjacent bottom lands which had kept all natural drainage blocked in the past. In one instance, a new small drain was cut in the low-lying portion of area "A" (see Fig. 1 map) where the gradient was 1/250 and at the same time a branch drain was cut in the hillside channel. One heavy shower which occurred before paving was completed completely filled the lower drain with about 350 cu. yd. of sediment over a length of 500 ft.

Although soil-savers form one of the best means of controlling sedimentation it was not feasible to use them in the area at Point Fortin. It was, however, proposed to construct them in conjunction with future road construction.

These soil savers are built of concrete or of corrugated pipe as shown in Fig. 4. Their object is to cause temporary ponding under full flow conditions so as to bring about sedimentation, and yet to allow eventual drainage of the pond at a low rate.

Flow into the culvert is controlled by the size and number of slots or perforations provided. These are generally made to carry only a small part of the flood flow. Full flow after ponding to allowable height is provided by the open top. In the concrete type, wooden slats are used periodically to block the openings according to the rise in ground level brought about by sedimentation.

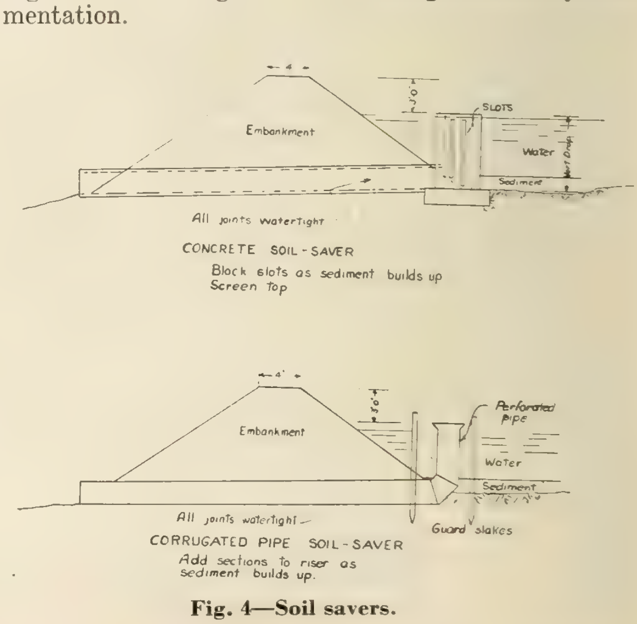

Fig. 4—Soil savers.

As a test case, a concrete soil-saver was placed at the head of a culvert under a newly-built road. Application of the Burkli-Zeigler formula gave a probable flow of 23.3 cu. ft. per sec. This indicated the use of 30 in. pipe. However, use of a drop inlet, height 4 ft., called for the use of the Ramser formula in computing the culvert size and indicated that a 24 in. pipe could be used.

Since the road fill was 8 to 9 ft. high, the length of culvert required was 48 ft. Purchase and placing of 30 in. pipe cost approximately $1.00 per foot more than 24 in. pipe. A reduction of $48.00 was made therefore in the cost of the culvert, and this more than covered the construction of the soil-saver.

Over a period of five months, sedimentation raised the ground level as much as 14 in. This was due mostly to a large new excavation upstream. The soil thus caught in the pond created would otherwise have settled in the drains farther down with considerable damage to the general drainage.

Structures of this type are also suitable where the flow from open channels must be accommodated by storm-sewer systems. For this purpose the soil-saver is used at any convenient location to pond the discharge from small streams and thus put it out of phase with the maximum discharge from the area of the town itself. This requires ponding or storage space sufficient to retain the stream flow until the run-off curve from the town area (for any storm of maximum intensity) drops. The two maxima cannot then coincide and the probability of flooding is decreased.

Low-lying Lands

In the low flat lands surrounding the residential area no advantage would have been gained by the paving of drains. These were straightened and graded to obtain the best possible flow, and were generally treated with asphalt emulsion to help preserve the sides of the drains when newly cut. Treatment was about ½ gal. per sq. yd. and was quite successful in keeping the slopes in good condition.

In new diversions the treatment was done before the stream was let into them, and it was then possible to treat the bottom of the drain as well.

In small channels the growth of grass tends to choke the channel in time. This was prevented by a spray of anti-malaria oil which, while made primarily for the destruction of mosquito larvæ, also kills the grass and weeds on which it is sprayed. One application of this oil in June should prevent the choking by grass, etc., of any drainage channel in the temperate zone during the summer.

In Fig. 1, areas B, C and D show normal drainage direct to the sea. Area D contains some swamp land but sufficient fall was available for normal drainage. Areas A and E were more difficut to drain, and a discussion of the treatment follows.

Area A

Natural drainage of area A was to the sea through the swamp lands shown. The section of the swamp land nearest the sea was generally at elevation + 4.0.

Sand had been thrown up by wave action to form a berm extending from the high ground on the left to that on the right. This reached elev. + 6.5 at the lowest part and effectively blocked the outlet from the swamp. Consequently, the area was generally flooded and drainage followed a cycle, as follows:

When the pond surface rose to + 6.5, drainage began and cut a channel in the berm. Pond level then fell to + 4.0. The ensuing rising tide blocked the channel with sand, and the pond gradually rose to + 6.5 again.

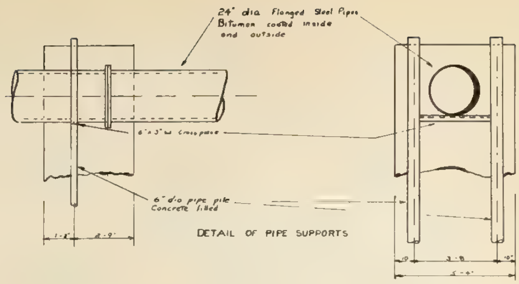

Fig. 5—Setting of automatic tidal gates.

Under this condition this area was an active breeding ground of anophelines throughout nearly the whole year.

A 30 in. circular Calco automatic gate had been installed some years before to drain the area, but had not functioned satisfactorily being stopped by sand. This gate was reset at elev. — 1.7 and the setting cast in the form of a box as shown in Fig. 5. From this, a 24 in. pipe outlet was placed on piles and extended to a point where the sea bottom was 3 ft. below the grade of the pipe. Actually a 30 in. pipe would have been more suitable, but since 24 in. bitumen coated pipe was available immediately, it was decided to use the smaller size.

Piles were of scrap pipe and were spaced so as to be close to joints in the 24 in. pipe. Pipe and pile were then encased in concrete from high tide to about 5 ft. below bottom. The results were very satisfactory, and with the addition of trash racks as shown, no further blocking of the gate occurred.

The main drain was cut as shown, and at a gradient of 1/500. Bottom width was 8 ft. and side slopes 1.5:1.

Rainfall recordings showed that the worst condition for this area was a rate of precipitation of 2 in. per hr. lasting two hours. Since the area comprised 15 acres, the probable run-off computed by the Burkli-Ziegler formula, using a coefficient of 0.40, is 16.2 cu. ft. per sec.

Actually the drain is very much larger than is required to accommodate this flow, but as will be seen, a certain amount of storage capacity was considered necessary.

The cumulative run-off during a period of two hours under the conditions given would be:

$$16.2 \times 2 \times 60 \times 60 = 116{,}640 \text{ cu. ft.}$$

which is equivalent to the storage capacity of a drain of this section over a length of 4440 ft., and which is much more than could reasonably be made available. As the drains actually were excavated, the storage capacity obtained is shown in Table I.

TABLE I

Storage Capacity of Drains

Pond El.	Drain "A"	Drain "B"	Drain "C"	Drain "D"	Total Cu. Ft.
1.5	——	——	——	——	——
2.0	550	——	——	——	550
2.5	2,380	300	——	——	2,680
3.0	5,780	1,400	300	——	7,480
3.5	9,900	3,520	1,400	300	15,120
4.0	14,600	6,320	3,520	1,400	25,840

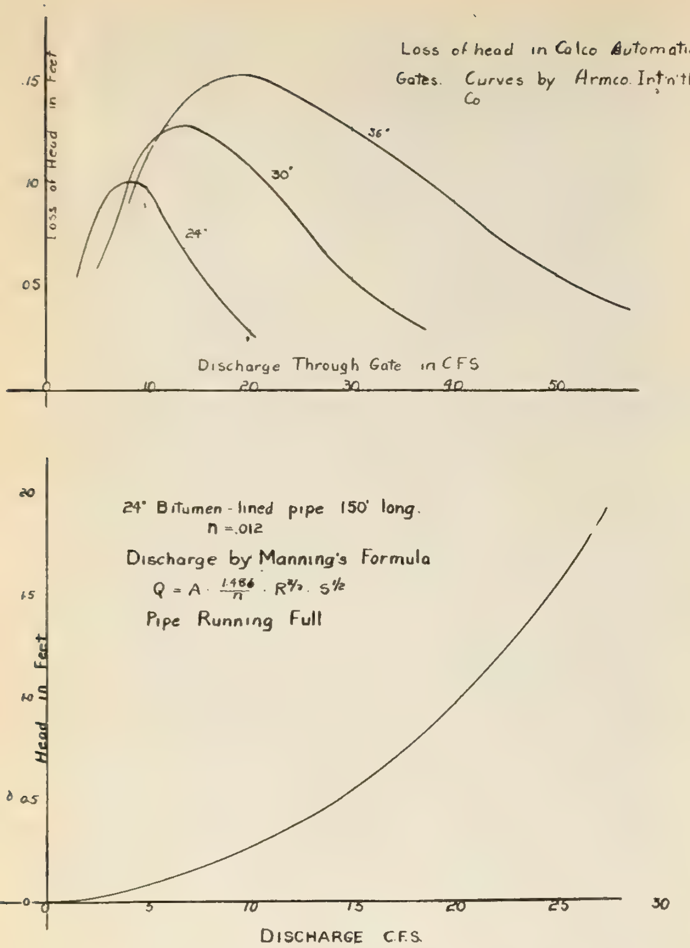

Fig. 6—Discharge of tidal gates at various heads.

Figure 6 shows that a head of 0.75 ft. on pipe and gate is sufficient to maintain a discharge equal to the inflow of 16.2 cu. ft. per sec. Thus it is apparent from the tide cycle, Fig. 7 that there is a period of 160 min. during the cycle when this head is not available with the pond surface not exceeding El. 4.0 ft. Obviously at any other time discharge will equal inflow and no flooding is possible.

It has been determined that for this area the critical time for a rainstorm of maximum intensity to begin is such that the maximum run-off begins to reach the outlet at zero time on the tide-cycle as shown in the figure.

Let us assume that a storm of 2 in. per hour lasting 2 hours takes place so that a flow of 16.2 cu. ft. per sec. just begins to reach the outlet at time 0, and that pond El. is then at + 1.8.

By computation we can obtain a series of elevations of the pond surface with respect to time, and the results are plotted against the tide-cycle.

The results thus plotted show the pond surface reaching El + 4.0 at time 110 min. Actually the rise would be something less than this due to the capacity of the small feeder drains which was not included here.

Time 110 min. represents the end of the period of maximum run-off, and since the time of concentration for the area is only five minutes, a rapid decrease in flow ensues. The pond level can scarcely rise much above El. + 4.0 due to the spreading of the water over the area at this elevation. Assuming it remains effectively at this elevation, discharge will vary from 13.5 cu. ft. per sec. at time 120 to a negligible amount at time 160.

The flow will then remain negligible until time 200 and will then begin to increase as the tide falls, and the system is again empty when the tide reaches El. 1.7, 4 hrs. and 20 min. approximately after cessation of the storm. This shows the swamp in a state of flood for about 1 hr. and 40 mins. At other stages of the tide than the one shown, flooding may occur, but will not be quite so long in duration.

That ordinary storms will not cause flooding of the area can be shown by a rough calculation:

Say storm of 1 in per hr. for 1½ hours.
Total immediate run-off 16.2/2 x 60 x 90 = 43,740 cu. ft.
Storage available 25,840 cu. ft.
To be discharged 17,900 cu. ft., or 3.33 cu. ft. per sec.

That this average discharge will be maintained over any time is reasonably obvious as this requires a head of only .03 ft. on the outlet pipe plus a head of .05 ft. on the tide gate, a total required head of .08 ft.

This system of drainage has proved adequate, and the pond surface was never observed to reach El. 4.0 afterward. Naturally, drainage could not be accomplished when spring tides up to El. 6.5 occurred, however this is normally in the dry season when there is very little precipitation.

Subsidence of the ground was anticipated and soon became noticeable. It was proposed to fill this area later up to El. 6.0 for other purposes and in so doing to leave drain sections. The additional storage made available would rule out any possibility of flooding under any conceivable conditions.

This area was connected to the Guapo swamp by a low passage between the hills marked " M " and " N " in Fig. 1. This was closed by a small dyke to prevent flood water from the Guapo coming into the area, as had occurred in the past.

Area E

Area E comprised about 400 acres. Below the Point Fortin main road most of the land was swampy and covered by dense jungle growth. Above this road, the major part of the area consisted of low hummocks and one large swamp. Drainage was into the Techier river, but practically no channels existed below the main road. Run-off from the higher portions spread out over the swamp land which was consequently very frequently flooded.

Existing culverts were all of adequate capacity but set too high for drainage of the ground upstream.

The general level of the swamp land was +7.0′ and the bed of the Guapo at the junction of the Techier was at +2.0′. The latter stream consisted of an almost uninterrupted series of short ox-bows below the main road.

The Techier was straightened and graded by the government at a grade of 1/2000 and beginning at El. 0.5 at the mouth of the Guapo, and was led into the latter at a new site at 3,000 ft. from the sea. The resultant elevation of the junction was +2.0.

A point was found about 500 ft. above the main road where it was possible to cut a connecting channel from the Techier into the Guapo. Since the Techier was considerably higher at this point than the larger stream, this was done, and the flow which had to be accommodated in the flat land below was materially decreased.

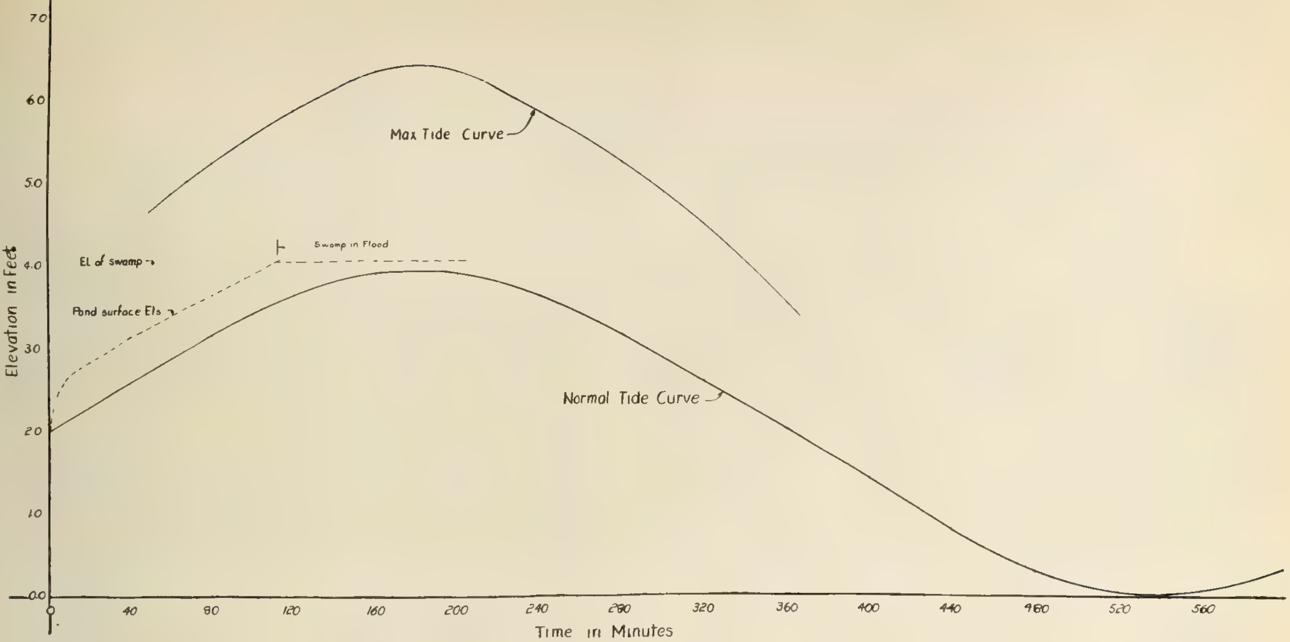

Fig. 7—Tide cycle.

The new point of junction for the Techier with the Guapo was chosen in the end of a small hummock where good foundation conditions for the tide gates were available.

Flow to be accommodated by these gates was, assuming 2 in. per hour rainfall:

From area "E"	115 cu. ft. per sec.
Techier (below diversion)	75
	190

Three 36 in. Calco automatic gates were installed. These allowed flow into the Guapo river but prevented backing up of the river into the area due to heavy local rains in other parts of the Guapo watershed.

Quantity to be discharged per gate 190/3 = 63.3 cu. ft. per sec.	
Loss of head in 36 in. gate @ 63.3 cu. ft. per sec. is................	.03 ft.
Head required to discharge 63.3 cu. ft. per sec. from 36 in. pipe,, 30 ft. long, outlet submerged, is	2.62 ft.
Total head required....	2.65 ft.

So, flooding could be avoided as long as the surface of the Guapo did not rise above 4.35 ft.

Studies of the flow in the Guapo river showed that the time of concentration is about 4 hours, and that very frequently the heavy showers occurring over the Point Fortin area were not wide-spread enough to cause flooding in this stream. Also it appeared that except under the most adverse conditions of tide, run-off should, with an efficient drainage system in the area under control, in many cases be completed before the Guapo rose to flood levels.

While it was not expected to remove all possibility of flooding, it was hoped that use of the gates would reduce the number and duration of the floods to such an extent that the ground might drain sufficiently to prevent breeding of mosquitos and become firm enough to be useful. From the point of view of malaria prevention alone the expense was justified.

The maximum surface elevation of the Guapo as actually observed was 9.1 ft. in which case all the swamp land below the main road became part of the Guapo flood plain. The readings taken showed that under normal rainy-season flow the surface elevation of the Guapo at the junction of the Techier was 1.0 to 1.5 ft. above the tide at its mouth. This results in an El. of 1.5 plus 3.9 or 5.4 ft. at the gates at high tide, and a head of 1.6 ft. can thus operate on the gates without flooding behind them.

Flow at this head is 30 cu. ft. per sec. per gate or 47 per cent of the maximum run-off. The short time of concentration for area " E " together with the long

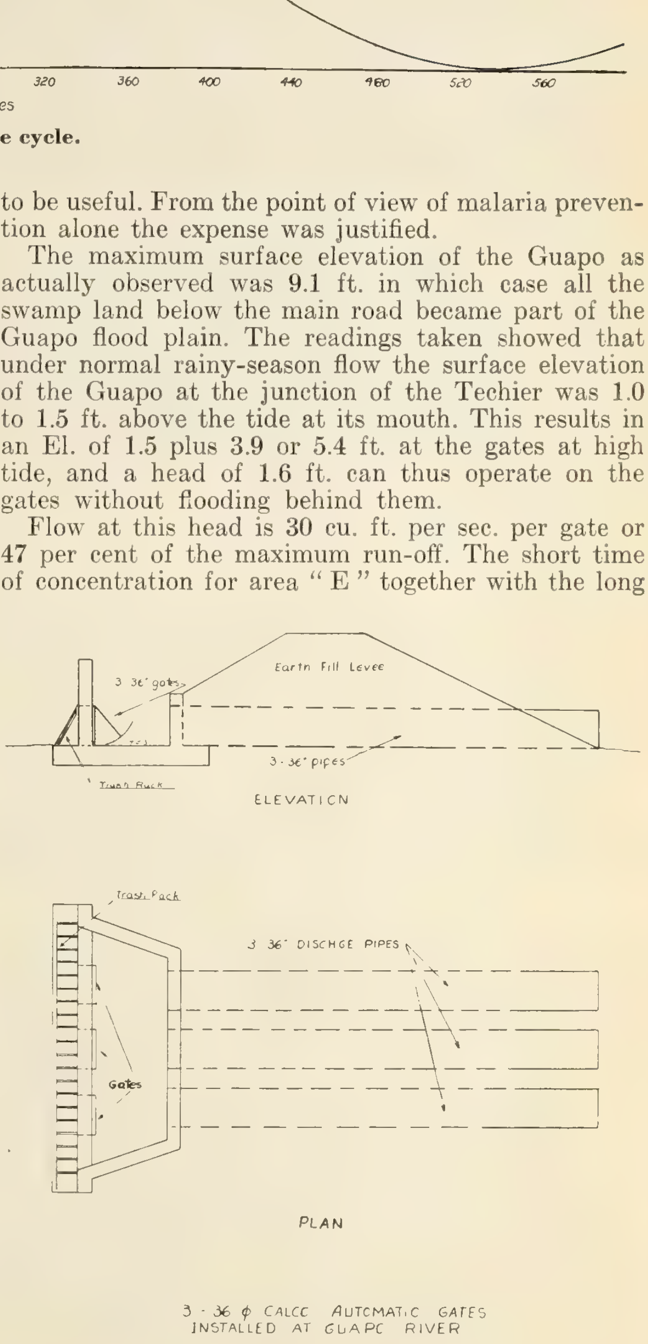

Fig. 8—Tidal gates for Area E.

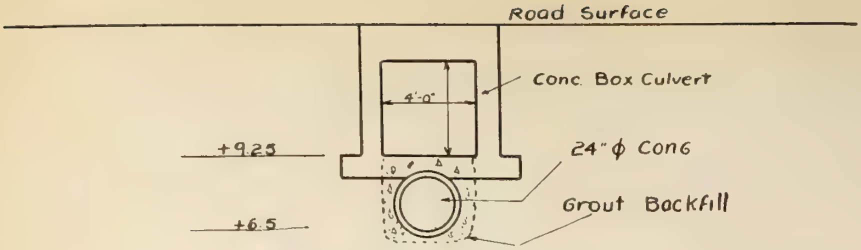

Fig. 9—Changes in box culvert.

time generally elapsing before the Guapo rose to any considerable extent was an item of importance here. The difference was exaggerated as much as possible by provision of an elaborate system of feeder drains to speed the run-off.

Experience showed that under short heavy showers the bulk of the run-off from the area was disposed of before the rise of the river closed the gates. Storage within the drains generally accommodated the run-off of the "tapering-off" period until a falling tide permitted a reversal of the head of the gates. Installation of the gates is shown in Fig. 8.

Construction of dykes was necessary as shown on the sketch-map (Fig. 1) to separate the area under control from the Guapo basin. These were small, and were placed by bulldozing material from adjacent higher ground.

The lower portion of the Techier's original course was filled in by the same means, and a small drain dug to accommodate the local flow. All by-passed portions of the Techier were carefully blocked with spoil from the new channel sections. Experience showed that where this was not done the division of the current between the old and new channels caused such a decrease in velocity as to allow blocking of both by sedimentation.

Provision of trash racks was found most necessary as otherwise the gates would have been blocked by debris very quickly. These racks required cleaning at frequent intervals.

As in other parts of the Point Fortin project, many drainage structures were found to have invert elevations too high to allow for adequate drainage above them. These were reset and replaced. In one case an existing box-culvert having a waterway area of 16 sq. ft. and an invert elevation of 9.25 ft. had to be altered. The ground above it was at El. 9.5 and was very swampy.

An invert elevation of 6.5 ft. was found necessary for good drainage, and an area of 6 sq. ft. sufficient. Since the culvert was under a main road it was decided to place a pipe culvert under the existing box without breaking the road surface. The concrete floor of the box-culvert was chipped out, reinforcing bent back, and the walls held apart by timber shores as this work progressed. After trenching to the required depth the 24 in. culvert was placed as shown in Fig. 9. Reinforcing was then bent back to place and spliced, and concrete poured to refill the excavation to the original floor level. Since the material of the fill was solid clay no settlement was caused.

An over-all plan for drainage of the area around Point Fortin was made and from it the required invert elevations of any culverts, etc. which might be placed in connection with other work could be determined. In this way it was hoped to avoid in the future the delay and expense entailed in resetting these later when the drainage programme extended to them, as it would in time.

RURAL ELECTRIFICATION

Development and Post-War Plans in Canada

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An address delivered before the Ottawa Branch of The Engineering Institute of Canada, on April 6th, 1945

Improvement of working and living conditions in rural areas of Canada by the extension of electrical services and by the wider use of the facilities which electrification provides is one of the most important objectives in post-war planning.

Many farms in the Dominion still lack the opportunity to function in the full stride of efficiency that modern conditions demand. Much time and labour have to be devoted to tasks which more suitable equipment would lighten and facilitate. And the home background, in comparison with the standards of comfort and convenience attained elsewhere, frequently leaves much to be desired and is often definitely discouraging. Such conditions impair morale, and, when widely prevalent, disturb the balance between agriculture and industry, with serious repercussions throughout the fabric of national life.

If Canada, to employ a mechanical phrase, is to hit on all cylinders both with regard to interior economy and contributions to world rehabilitation, the farmer, insofar as possible, must be enabled to adjust his working routine and his standards of living to modern concepts of progress and efficiency. Electricity, on account of low cost and flexibility in application, is a prime factor in establishing the farm on a higher productive basis and in providing the farmer and his family with a more stimulating background of home life.

Rural electrification is no new idea whose value awaits experimental proof. In other countries, as well as in Canada, its benefits have been manifest for several years. In New Zealand the vast majority of farmers already have electrical services. Just before the war, three-quarters of the rural population of France was using electricity. In Holland and Denmark, practically every farm house was equipped. Central station energy is supplied to about 75 per cent of the farmers in Sweden. And rural services in several of the states of the neighbouring American republic have reached a saturation of 80 to 90 per cent.

History of Development in Ontario

Ontario was the first of the provinces of the Dominion to develop and distribute hydro-electric power. It was also the pioneer in rural service.

In 1906, the Hydro-Electric Power Commission of Ontario was formed at the urgent instance of Sir Adam Beck and his associates to act as trustee for the municipalities in producing and distributing electric energy. As time passed the Commission took over plants at Niagara Falls, undertook the construction of the Queenston-Chippawa development, bringing the total capacity at Niagara to 830,000 hp., and, by new developments and purchases in other parts of the province, kept abreast of increasing industrial power demands and was able to intensify and expand services in the rural field.

Distribution of electric power to the rural sections of Ontario was at first the direct responsibility of the townships. The Hydro-Electric Power Commission supplied the capital for the primary lines, but the townships themselves undertook the actual construction of the distribution system.

In 1920, under what was known as "The Rural Power District Scheme", the province was divided into districts of approximately one hundred square miles each. Every district was operated as a unit of the H.E.P.C., with its own accounting rates which were adjusted from time to time on an "at cost" basis.

In 1921, the Provincial Government passed legislation providing for a bonus of fifty per cent applicable to the cost of all primary lines to serve rural customers. This had the effect of reducing farm service charge from an average of $6.20 to $5.07 net per month. During the following years the service charge was still further reduced until, in 1936, it stood as low as $1.00 per month. Energy rates for individual districts were also substantially lowered.

As the number of consumers increased, the multiplicity of rates and classifications proved unwieldy and unsatisfactory in individual application. Furthermore, the duplication of administrative services required to operate the various rural power districts was not conducive to a minimum cost for power. In 1943, the Power Commission Act was amended to permit the amalgamation of all rural power districts into one district as far as administration and operations costs were concerned.

In January 1944, with the consent of the Provincial Government, the farm service charge was abolished and the disparity in energy rates between different districts was removed. Simplified energy rates of 4 cents per kwh. for an initial specified block of energy, 1.6 cents per kwh. for a second block and 0.75 cent per kwh. for subsequent energy used were established and made applicable to all classes of rural service.

These reductions and simplifications in rates have encouraged a greater use of electricity by rural consumers and have assisted the Commission in securing legislative approval for a still further reduction. In effect from May 1st 1945, a new rate has been approved for all rural Hydro users. The cost on the first block of energy used is now 3.5 cents per kwh. instead of 4 cents as formerly.

Economics of Rural Electrification

Lower cost of electricity to the farmer depends upon increased use. So that all the changes recorded have depended primarily upon the extension of transmission systems and the construction of new line.

Farmers, like other sound-thinking people, are resistant to change unless some definite advantage is in prospect. During the early days of Hydro there were few of those appliances available which today take the drudgery out of farm life and materially assist production. For this and other reasons, while the accelerated use of electricity was transforming industry, its development in the rural field was in nothing like the same ratio.

From 1925 to 1930, rural Hydro was definitely on the march. Then it had to face a serious obstacle. This

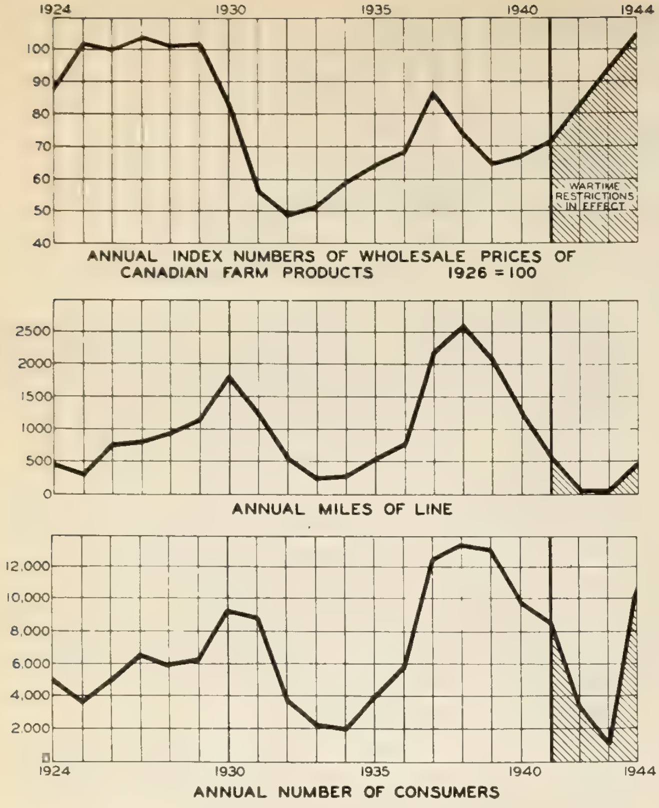

Fig. 1

was the great economic depression. It retarded the growth of farm Hydro to the equivalent of three years' normal development, regarded in terms of the previous trend.

In this connection, it is interesting to compare the declining wholesale prices for Canadian farm products with diminishing Hydro development.

This is best considered graphically.

Referring to Fig. 1, it will be seen that the Hydro construction and consumer curves closely parallel the trends of the price index curve. This, of course, reflects the close connection between rural development and the level of farm income.

It is also interesting to note that, in point of time, the development curves follow rather belatedly the trends of the farm prices' curves. In other words, during the first year of the depression the demand by farmers for electrical installation continued unabated. It was only when the depression, with its disastrous effects on farm prices, came to be looked upon as a more or less established misfortune, that Hydro growth was substantially curtailed.

The consumer curve also indicates the effect of wartime restrictions on material and labour in curtailing the rural development in spite of the rapid improvement in the price index and the consequent renewed demand in rural districts for more power.

In spite of the handicaps upon growth caused by war and depression, the development of Hydro in rural Ontario, considered in five-year periods, has been continually progressive, as the growth pictographs in Fig. 2 indicate. As will be seen, there are now 21,045 miles of distribution line constructed, bringing Hydro electric services to 61,486 farms, which represent about 55 per cent of the farms in the province.

Present State of Development in Provinces

While more than half of the abundant water-power of Canada is contained within the boundaries of Ontario and Quebec, no province in the Dominion is denied water-borne sources of electricity.

On the prairies, various conditions for many years operated against rural electrification, but more recently considerable progress has been made, especially in Manitoba.

In Manitoba, prior to 1928, less than 60 farmers were served by the Manitoba Power Commission which was set up in 1919. The pre-war depression, however, which was felt with particular severity in Manitoba, led to the exploration of prospects for a more varied type of farming to offset the hazards entailed in the exclusive cultivation of grain crops, and, as a result, rural electrical development was greatly encouraged. By 1942 there was a total of 1,109 farmers supplied with electricity, of whom 561 were customers of the Manitoba Commission.

Electric services of a modified description are available to 35.8 per cent of the farms in British Columbia.

According to the report of the Rural Electrification Committee of British Columbia (January 1945), there were no less than sixty-five separate organizations engaged in providing central station service in that province. With the exception of the Lower Mainland (including the Fraser Valley), the cost of electric service throughout the rural areas was said to be relatively high, and the quality of service relatively poor.

The province of Quebec occupies a major position as a producer of electric power, but a high percentage of the electricity generated has been applied to industrial services. Figures for 1942 show that there were 28,419 farm customers in Quebec as against 66,075 in Ontario. The latter figures include other scattered rural services which are supplied in addition to those of the Hydro-Electric Power Commission.

Post-War Plans in Provinces

Definite programmes for future rural electrification designed to achieve far-reaching results, both in saturation through extension of services and in intensity through the increased use of electricity already available, have been drawn up in Ontario and in several of the other provinces of the Dominion. These programmes will be put into effect as soon as the restrictions imposed by the war permit.

IN MANITOBA

In Manitoba there is a ten-year plan for rural districts. This provides for a minimum of 1,000 new farm consumers to be connected in the first year. Electrical services will be made available to a steadily increasing number in subsequent years, depending upon the experience gained and the state of unemployment prevailing. Twenty-five thousand farm services will have to be installed to secure the objective of 80 per cent saturation.

The capital cost of this programme in Manitoba is estimated at $16,831,687.50. At the end of the ten years, and after deducting sinking fund, the net debt for the 25,000 farm services will amount to $14,426.-800.52. On the same basis, the capital cost per farm service is estimated to be $673.27.

There is said to be adequate power available from the Winnipeg river, in Manitoba, to provide for a complete farm electrification system in that province. It is estimated that the average peak demand per farm will be 600 kilowatts and that the peak demand for 25,000 farms will not exceed 30,000 hp. at the power plants. This constitutes only five per cent of the total power available from the Winnipeg river.

With respect to this post-war plan, the Manitoba Electrification Enquiry Commission has recommended that, since farm electrification can be established only under conditions of maximum economy, farm lines should become an integral part of the Manitoba Power Commission. Organization of local advisory and promotional bodies is urged to facilitate the signing-up of as nearly 100 per cent of the farmers in the community as possible. In less densely settled areas, farmers will be expected to organize themselves into self-help bodies under which they will be able to secure credit or cash for electrical material and appliances.

The importance of this ten-year rural electrification plan to the welfare of Manitoba is emphasized in these conclusions drawn by the Enquiry Commission.

" In a dynamic world, economic activities must undergo a constant process of adaptation; if they stagnate they are likely to be left badly adjusted in terms of both cost-price relationships and desired type of product or service. The Manitoba economy had been subject to an unusual array of disturbances, and the march of change is likely to continue. For this reason every effort must be made to encourage developments which will further the adaptive process. Electric power on the farm is an indispensable weapon with which the Manitoba farmer can facilitate the adaptive process and which will bring better co-ordination between urban and rural activities in the province of Manitoba."

IN BRITISH COLUMBIA

In British Columbia, a bill which provides for the setting up of a three-man Hydro-Electric Commission and the expenditure of $10,000,000 in the first year of an extensive but not definitely dated rural electrification plan has received approval.

As many of the small private power utilities in British Columbia are inadequately equipped to supply more than lighting to farm customers, the first step in post-war rural development will be the consolidation of these plants into a unified central station industry. Twenty-three of them will be affected in the initial stages of reconstruction. They will be amalgamated into one system, while further power resources will be tapped through the construction by the new commission of a hydro-electric power plant at Nanaimo.

Major power-producing industries in British Columbia will be expected to effect improvements to their rural customer services in harmony with the general scheme of development.

IN ALBERTA

In its interim report to the Alberta Legislature in March 1944, the Post-war Reconstruction Committee of that province has this to say about rural electrification:

" Probably no one factor would do more to modernize agricultural life than a well-planned scheme of rural electrification. The Committee assigned to the Research Council of Alberta the task of surveying the possibilities of such a scheme, and while this final report will not be available for some time, progress reports indicate that there is sufficient power available and that existing transmission systems should be capable of serving the more densely settled areas without prohibitive cost."

The Committee is of the opinion that the capital cost of rural electrification should not all be passed on to the consumer in the form of a higher service rate but should be borne in part by government.

The production and distribution of electrical energy

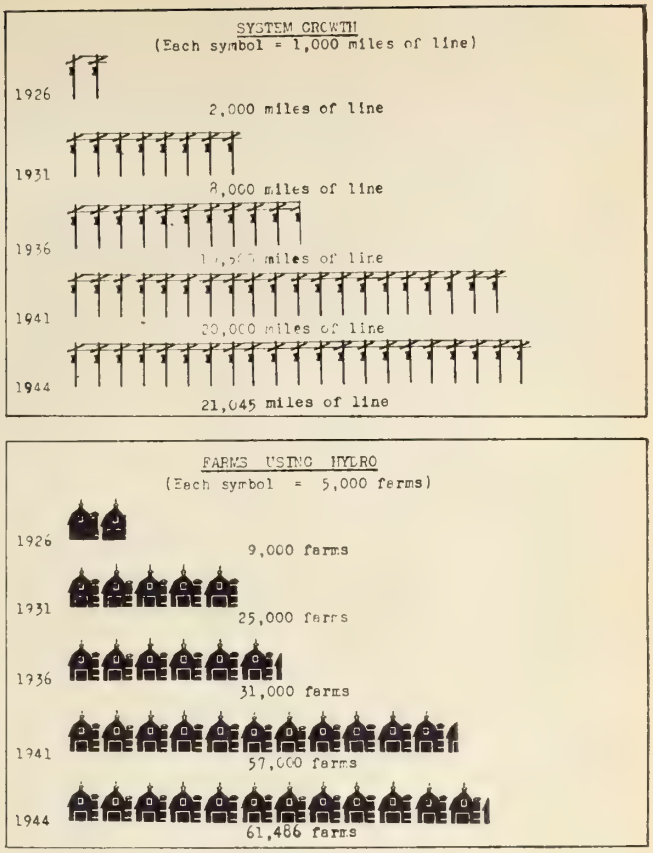

Fig. 2

is in the hands of private enterprises in Alberta, but some of the utility systems are co-operating this year with the provincial government in an experiment which may have far-reaching results* They are supplying electricity to certain specified rural areas with the object of determining by actual test the possibility of a more general extension throughout the province.

IN THE MARITIMES

In Nova Scotia, New Brunswick and Prince Edward Island, plans are crystallizing for extensive post-war rural electrification. Addressing the Kiwanis Club of Halifax, E. J. Cragg, commissioner-manager of the Nova Scotia Power Commission referred to electricity as " a need of man, from the time he enters the world until he leaves it."

IN QUEBEC

Further extension of rural development in Quebec is forecast by the formation of a Rural Electrification Bureau. This will consist of three members appointed for a term of ten years. The newly appointed Bureau will encourage the creation of local co-operatives who will supply their members and others as well with electrical services. They will take over any previously existing co-operatives.

The Bureau will divide the province into rural electrification zones and allow to each co-operative a specified field of action. It will make loans to these co-operatives up to 75 per cent of the value of the property acquired by them and it will also make them advances in anticipation of loans as they proceed with the construction of the necessary facilities. Engineers and legal assistance will also be supplied by the Bureau.

*See *The Engineering Journal*, April 1945, p. 227.

Rural development carried out systematically and progressively in Ontario for many years has given the Hydro-Electric Power Commission of this province a firm foundation of experience from which to proceed with post-war plans.

In keeping with its tradition of providing the benefits of Hydro service to all sections of the community whether they be urban or rural, industrial or agricultural, the Commission will undertake the early completion, as soon as conditions imposed by the war permit, of sufficient rural power lines to serve all the farms in the province which can be practically brought within reach of its service.

The Commission proposes to reach the ultimate development in two stages. The first stage takes the form of a five-year plan to be carried out in the early post-war period.

This plan calls for the construction, spread over five years, of approximately 7,300 miles of distribution line with service equipment to supply 58,000 new customers, including 32,000 farmers. Interpreted in terms of saturation, this means that, at the end of the five-year period, 85 per cent of all possible farm consumers in the province will have electricity at their disposal.

The estimated cost of this construction programme is $22,500,000. Fifty per cent of this sum will be provided by provincial subsidy.

Such an undertaking obviously calls for all-round co-operation. If the full benefits of the five-year plan are to be realized, if farming in Ontario is to be placed on the high level which modern conditions and the farmers' interests imperatively demand, then the farmer will have to play his part, and, in turn, will have to be supported by finance and industry.

Electric service can be made available to the farmer. But this is only one side of the picture. If the farmer is to derive the full benefits from the use of electricity, if he is to make his farm a modern and profitable establishment, he must equip himself accordingly. This entails the purchase and installation of all necessary electrical appliances; and, of course, as a preliminary step, the farmer must see that his premises are adequately wired or re-wired.

The Commission estimates that the execution of its five-year plan will create a market for wiring and electrically-operated equipment totalling approximately $40,000,000. When the expenditures of the Commission in supplying lines and services are added to this amount, the total outlay is seen to be in the neighbourhood of $63,000,000. This is an average of over $1,000,000 a month for the five-year period.

Big Opportunities for Equipment Manufacturers

This market will provide an opportunity for the manufacturer of electrical appliances and farm equipment to get off on the right foot in post-war production. If he cultivates it to the fullest possible extent by making his products available to the farmer at the lowest possible cost and with the maximum of service, he will not only be serving his own interests but he will be playing his part in establishing agriculture on a thoroughly sound basis.

In effect, the manufacturer must be prepared to develop and provide the types of equipment which the farmer requires. He must be ready to furnish these appliances in the necessary quantities and at economical cost, and he must seek the most equitable methods of distribution.

It has been estimated that the Ontario five-year plan alone will entail the installation of a large number of household appliances, including 18,800 electric ranges, 58,000 washing machines, 7,000 water heaters, 90,000 electric irons, 25,000 electric refrigerators, and 95,000 radios. For farm equipment installations there will be a correspondingly large market. Included in the estimates are 5,500 electric grain grinders, 3,100 milking machines, 7,500 water pumping systems, and 2,300 milk coolers.

The Farmer Requires Assistance

In providing himself with the installations which are essential if electric services are to achieve maximum results, the farmer, in many cases, will require financial assistance. This has been anticipated by both Dominion and provincial governments.

In Ontario, previous to the war, the provincial government, through the Rural Power District Loans Act, had provided a means whereby farmers could finance their installations over a five-year period at an interest rate of five per cent. In 1940 on account of wartime restrictions, this procedure was discontinued, but it is planned to resume these rural loans following the war, and it is probable that the interest rate will be reduced to four per cent.

The Federal Government, through the Farm Improvement Loan Act of 1944, has made available a system of credit loans, designed to meet the special needs of Canadian farmers. Such loans may be advanced by the chartered banks of Canada up to a total of $250,000,000 on the basis of an interest rate not exceeding five per cent, and are substantially guaranteed by the Dominion government.

At the present time, the farm income of Canada is at a relatively high figure, and there is every indication that this income will be maintained at high levels for a period of some years following the war. Taken in conjunction with the availability of the loans previously mentioned, the farmer should be placed in a most favourable position to undertake the necessary electrical installations on his farm. However, if the maximum results are to be attained, he must have the sympathetic co-operation of industry and finance in carrying out his programme.

A Co-operative Undertaking

Because of the central position which agriculture holds in the national economy, and because of the employment which the rural electrification programme will give to large numbers of people during the most difficult period of readjustment, rural electrification should rate a high priority among post-war projects, and it should invite the highest confidence from all sections of the business community. In fact, if the proposed programmes are to meet with the desired degree of success, they must be carried forward with the interest and support of the electric utility, the manufacturing industry and the financial institutions, working co-operatively.

A flourishing agriculture is the basis of Canadian prosperity. Manufacturing, commerce, financial institutions, industrial labour are all definitely interested in the question as to whether the farmer is to make a "go" of it or not. It is, therefore, from every point of view, sound business to give the farmer the fullest possible support in his endeavours to improve his position productively and to better that home environment, which provides such an important background to the efficient carrying out of his daily tasks.

FLAME-PRIMING STEEL SURFACES FOR PAINTING

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SUMMARY—An investigation into the chemical aspects of rust and mill scale, and an account of latest findings on the increased resistance to corrosion of surfaces that have been flame-primed before protective painting. Applications of the process are given.

Research into the protection of steel surfaces afforded by painting indicates that the preparation of the surface is equally as important as the painting itself. The surface, in addition to being cleaned of loose scale, rust and contaminants, should also be dry and warm, because it has been shown that even a single molecular layer of moisture or some other incompatible material on the surface will not only prevent satisfactory bonding of the base coat but will permit corrosion to continue after the coat has been applied (1). On a warm, dry surface, the paint will flow readily, continuously wetting the entire surface and carrying the inhibitors into intimate contact with the surface where needed for effectiveness.

While the beneficial effects of painting on a clean, warm, and dry surface have long been realized, it was not until the oxy-acetylene flame-priming process was introduced several years ago that all three of these desired conditions could be achieved. Following its introduction, flame-priming has proved its efficiency, speed, and economy in theory and practice, as evidenced by the fact that well over 20,000,000 sq. ft. of steel surfaces are now being treated by this process each month.

Principles of Flame-Priming

The flame-priming process consists of " scrubbing " steel surfaces with a series of closely spaced oxy-acetylene flames that have an extremely high temperature and high velocity. As a result, all mill scale that is not tightly bonded is popped loose by sudden thermal expansion, and physically adsorbed and chemically combined water is driven off from any rust that is present, leaving stable oxides in their place. (Fig. 1). At the same time other contaminants such as oil and acid salts are consumed or disintegrated by the flames. The surface is then swept or wiped free of loosened foreign material, and painted while still at an elevated temperature.

This procedure not only brings about improved corrosion resistance of the paint coating, but also increases cleaning and painting rates and reduces setting time for the paint. As a further advantage, painting can be carried out under conditions of low ambient temperature or dampness which would otherwise cause major delays. The time saving with the process is of particular importance at the present time when continuous production without delays in the fabrication and painting of steel is required.

It should be noted here that the term flame-priming is now designated for the process at the suggestion of many industrial users. It is felt that the word " priming " best expresses the effect of the process, not only upon the surface to be painted but also upon the paint coat itself. In addition to cleaning and drying the surface, it is heated, thus giving the subsequent paint coat the effect of a low-temperature bake. For this reason, flame-priming seems a more expressive term than flame-cleaning, de-scaling, or de-hydrating. These latter terms are still widely used for those applications where no paint is applied in conjunction therewith or where it is applied at a later date.

Flame-Priming Equipment

The heating action in flame-priming is produced by flame-priming heads, ranging in widths from 1 to 12 in., which can easily be attached to standard welding blowpipes, either directly or by means of an extension arm. The entire unit is light, well balanced, and easy to handle. The head is protected from wear or damage in use by means of hard-faced wear pads and skids, which also serve to keep it automatically at the correct distance from the work. A 6-in. head, the size most frequently used, has 49 flame ports that are spaced ⅛ in. apart, and are No. 75 drill size, or approximately 20 thousandths of an inch in diameter. Despite this extremely small diameter, the flames are over ¼ in. long, indicating the extremely high velocity of the burning gas jets, which increases the " blasting " effect of the flames and therefore their efficiency. Because of the high velocity of the flames and the design of the flame ports, these flames are extremely resistant to popping

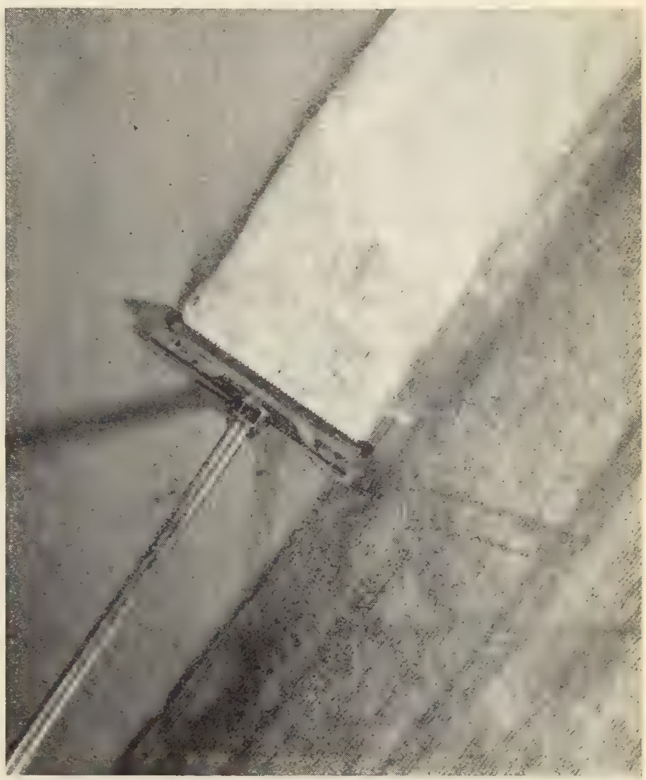

Fig. 1—Showing the flame-priming head which is attached to the standard welding blow pipe. The dark streaks that appear on the plate surface are black magnetite and the silvery streaks between them are sponge iron.

or clogging under the most severe operating conditions. The technique of manipulating the blowpipe is easily learned and requires no special skill. In fact painters, with no previous experience in using the oxy-acetylene process, have been trained in five minutes to do flame-priming satisfactorily.

The ready portability of all equipment necessary for flame-priming, including supply sources of oxygen and acetylene, makes the process as suitable for use in the field as it is for shop use. In the shop, oxygen is usually supplied by a piping system and acetylene from a generator, while in the field, oxygen and acetylene are usually supplied from manifold cylinders.

Effect of Flame-Priming on Rust

In any discussion of the effects of flame-priming on rust, some mention should first be made of the nature of this product of corrosion. Rust is an inter-bonded, chemical and physical adsorption of water with iron oxides (2). The rust normally encountered on steel work is the wet, reddish brown precipitate resulting from the oxidation of the ferrous hydroxide that has been formed by the action of water upon iron. This precipitate is a hydrated iron oxide having varying amounts of physically and chemically adsorbed water. The physically adsorbed water is the moisture which can be seen or felt, while the chemically adsorbed might be considered comparable with water-of-crystallization.

A thorough wire brushing alone is not sufficient to prepare a rusted surface for painting (3), since this physical wetness causes the rust particles to adhere with a persistence that defies brushing. In flame-priming, however, depending upon the surface temperature reached and the length of time during which it is maintained, a series of reactions takes place beneath the flames which reduce this wet, hydrated oxide to ferroso-ferric oxide or even to sponge iron, both of which are loosely bonded, granulated powders that can readily be brushed away.

The heat first dries out the physically adsorbed moisture, and breaks down the rust, leaving an anhydrous oxide (4). Simultaneously, the reducing gases in the flames (5) react chemically with the oxides to reduce them to ferroso-ferric oxides or black magnetite, which is highly stable (6). The formation of this black powder, which in most flame-priming operations gives the surface its characteristic appearance, indicates that all moisture has been driven off (6). Thirty years ago it was conclusively proved (7) that such a surface would be desirable for painting but at that time oven-baking was used and was not practical for most work.

The de-oxidizing action which reduces the surface rust to black magnetite can be continued still further to reduce the surface particles to sponge-iron by moving the flames more slowly over the surface. It is only a superficial effect and occurs only in the reducing atmosphere at the tip of the inner cone flame as shown in Fig. 1. If this granulated powder were brushed lightly, it would be found that the sub-surface layers were not discoloured or de-oxidized. Only the moisture would have been driven off; the reducing gases would not have diffused to any great depth. Nor is it necessary that they should. Tests (7) show that dehydration alone is sufficient. The discolouration serves to indicate that the dehydration of the sub-surface is complete.

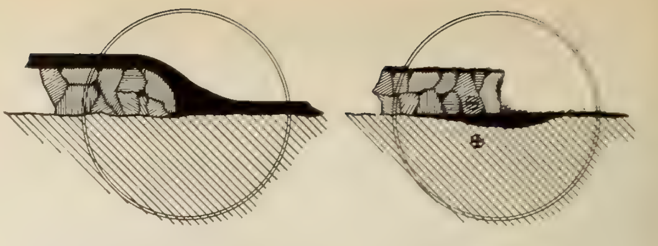

Fig. 2—Diagram illustrating action of mill scale on steel.

The warm, dry, granulated powder produced when rust is treated with oxy-acetylene flames can be swept from the surface with a light brushing. It is very porous, and, therefore, tends to pick up contaminants as soon as it cools. Because of this "activated" condition, it should be either brushed away before painting or painted while hot. If it is painted hot, its absorptive characteristics insure its thorough blending into the coat where it becomes a portion of the pigment. It is of the same composition as part of the pigment used in many present day anti-corrosive coatings. In this connection it should be emphasized that the surface should be painted while still warm.

Effect of Process on Mill Scale

Prior to the advent of flame-priming, scale on steel surfaces was a major problem. Wire-brushing did not remove all that was loose enough to flake off as the paint coats set, and also the invisible (but nevertheless present) moisture on the surface and in the rust set up small electrolytic cells between the iron oxide and the steel. These cells concentrated their etching action across the shortest path, the bond between the scale and the steel, and thereby continued to loosen more scale. This action is illustrated in the right-hand sketch of Fig. 2.

Flame-priming not only corrects this fault of mill scale but, in doing so, it renders it advantageous in that its presence prevents corrosion when the paint coat fails. In the right-hand sketch of Fig. 2, the surface has been flame-primed, wire-brushed, and painted. The flames have forcibly removed all scale which could conceivably be considered loose. The paint has been applied on the warm, dry, surface with the result that its surface tension and viscosity have decreased. The improved mobility causes the vehicle to penetrate all irregularities, bringing the inhibitors into intimate contact with the surfaces where they are necessary for effectiveness in case water eventually does penetrate. Any fissures in the scale are sealed and the junction of the scale and steel receives an extra fillet of protection. In addition to this, the coating is baked by the heat, reducing voids and assuring longer life.

Should such a surface be exposed without additional coating, it is obvious that the scale would serve to protect the metal beneath long after rusting had started on the unscaled portion to the right.

From this discussion it should be obvious that it would be desirable to obtain steel with the maximum amount of tight scale intact (8) and paint it before any rusting could spread from the exposed area to undermine the protective layer. This, of course, is not practical, but flame-priming is the nearest artificial approach to this condition. It has been further shown by actual tests (9) that the less rusting which takes place before flame-priming, the more scale will be left intact and corrosion resistance will be greater. The U.S. Navy points this out in its specifications on this process which require that the steel be painted as soon as possible after arrival at the yard.

In flame-priming, the removal of scale results from two similar forces: either a differential expansion between the entire scale layer and the base metal; or by the differential expansion between top and bottom surfaces of the scale. In the removal of heavy scale in which heat conductivity is low, the expanding force of even a relatively slow heating rate will cause the scale to expand and buckle off the base metal before the base metal shows any tendency to become hot. On structural shapes and relatively thin plates that have been finish-rolled at relatively low temperatures, there usually is a good thermal bond in addition to the physical bond between scale and base metal. Consequently, in its removal there is a tendency for heat to be conducted away almost as fast as it is poured into the surface. It is necessary, therefore, to supply heat to the top surface of the mill scale at a rate so high that it exceeds by far the rate of conduction away from it. In this manner, a superficial expansion takes place while the base metal and scale interface is still relatively cool and brittle. Special oxy-acetylene flames have been developed for this application. The flame ports are designed to produce exceptionally high velocity and high temperature flames capable of producing a sudden heating action with extremely low consumption.

Flame-priming, while removing the loose scale and dehydrating rust, does not remove any scale that, because of its tight bond, would serve as a protection against corrosion. It has been shown that any scale that can resist the stringent expanding action of the sudden heating effect of high-temperature high-velocity flames is sufficiently tight to resist subsequent flaking. In fact, to bring about a margin of safety, flame-priming actually removes some scale which could be satisfactorily left on because of its high bond strength (10).

Consequently an increased protection against corrosion is effected. The tendency for mill scale to give trouble under paint is reduced, while the tightly bonded scale is retained as an added protective measure.

Effect of Flame-Priming on Chemical Salts

Surfaces which have been exposed to the corrosive action of acid atmospheres usually have, in addition to a rust deposit, a mixture of acid salts which, being hygroscopic, tend to pick up and hold moisture. These salts cannot be removed completely by wire-brushing alone, no matter how thorough. By flame-priming, however, moisture is driven out of the salts, leaving anhydrous, granulated salts which can be brushed away, leaving a clean surface ideally prepared to receive the protective coating.

Temperatures Resulting from Flame-Priming

When the flame-priming head is passed over a steel surface, a superficial layer of the metal is momentarily raised to an extremely high temperature because of the high rate of heat transfer from the flames to the plate. After the flames have passed on, this small amount of heat in the thin, high-temperature zone is given up to the base metal. If the surface is coated with a layer of scale that has a low heat conductivity, the instantaneous surface temperature is comparatively high, since heat is conveyed into the base metal slowly. However, if the metal surface is relatively free of scale, the rate of heat transfer is high, and the maximum temperature reached on the surface is lower. It can be reasoned from this that where rust and mill scale exist, their low thermal conductivity will effect high superficial temperatures which will produce the desired dehydrating action.

The base metal temperature resulting from flame-priming likewise is affected by the thickness of the steel being treated. The final temperature of a relatively thin plate will, of course, be high when compared with the temperature of a thicker plate subjected to identical treatment. Then too, some structures are flame-primed on both sides, such as I-beams, while others are flame-primed on one surface only, such as storage tanks. Consequently, because of these variations, it is impossible to state the exact temperature of steel surfaces after flame-priming, although in most instances it ranges from 125 to 150 deg. F.

Effect of Heat on Coatings

When paint is applied on a warm surface, its corrosion resistance is increased. The removal of contaminants makes it possible for the vehicle to reach the steel surface where the polar attraction forces can exert themselves to produce a greatly increased bonding strength. It is this property which arrests corrosion-creeping. The heat increases mobility and hastens the evaporation of solvents. The highest temperature being at the metal interface, the solvents do not tend to be trapped by any skin formation and, consequently, voids and blisters are less frequent. The rate of setting is speeded up by an increase in polymerization of the vehicle caused by the baking action of the heat. This produces a tougher and more lasting film (10) as well as making possible a desirable reduction in drier content.

Flame-priming and painting should therefore proceed as a continuous operation. The operator handling the flame-priming blowpipe should be followed immediately by the helper sweeping down the surface, who in turn is followed by the painter.

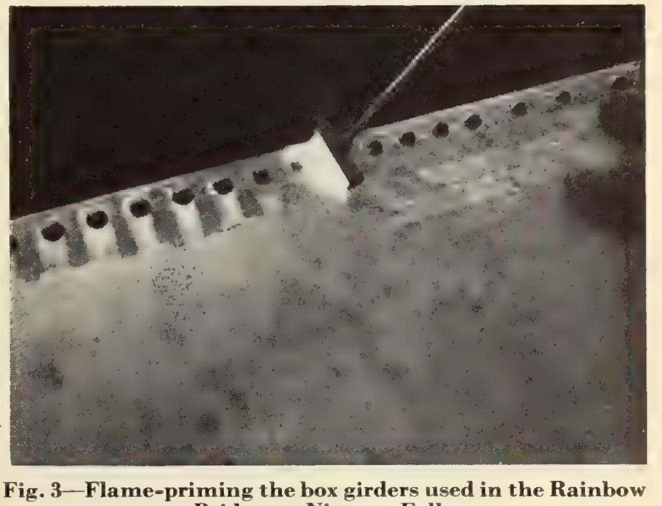

Fig. 3—Flame-priming the box girders used in the Rainbow Bridge at Niagara Falls.

Also under the subject of heat effects, comes the question of the possibility of distortion resulting from flame-priming. When the process is conducted in accordance with recommended procedures, distortion may be dismissed as a problem—because, although temperatures are high, the quantity of heat actually introduced into the base metal is low (because of the speed with which the flames are passed over the surface). It has actually been shown that the deflection in a structural member that has been flame-primed is less than that produced by radiant heat from the sun, which causes a continuous temperature difference between the exposed and shaded sides.

Evaluation Tests

Flame-priming shows up consistently well in exposure tests. Some authorities feel that the general value of panel tests, as indications of corrosion resistance, is open to question, because conditions established in such tests do not always accurately exemplify all conditions. Consistent results in many tests overcome these objections. A number of tests have been run in the past, conducted by users of flame-priming under their own conditions and with their own materials, with results uniformly favourable to flame-priming. Detailed reports of these tests are not generally available. In a few cases authoritative tests have been conducted.

One series of tests, however, reported by the American Institute of Steel Construction, would appear to be representative, authoritative, and conclusive. These tests were conducted by one of the large steel fabricators working in conjunction with a large and reputable paint laboratory. With the knowledge and facilities of both groups, a series of thorough tests was planned and executed in which flame-priming was compared with other processes in general use. The scope and execution of the programme included the testing of three common methods of surface preparation—flame-priming, sand-blasting, and hand-brushing—with variations of each. Three grades of primers were used: iron oxide and linseed oil, red lead and linseed oil, and a premium-grade proprietary brand of primer. Moderate-sized structural shapes were used as specimens and were exposed in an inland industrial area and in a salt-air atmosphere on board ship. The exposure period for a single coat was one year.

Fig. 4—These operators are flame-priming, sweeping and painting part of an order for 4,000 tons of structural steel members used in the construction of an overhead parkway system.

The three methods of surface preparation used included " the best sand-blasting practice that could be obtained in connection with heavy fabrication, such as bridge girders," flame-priming in accordance with the specifications of the American Institute of Steel Construction, and hand-cleaning in accordance with the best practice followed by reputable operators working under the usual inspection conditions. Both new and weathered steels were used. Thus, in one group of specimens, the mill scale was intact and free of moisture, while in the other, large portions of scale had rusted off and exposed areas were rust coated. As expected, the new steel, fresh from the mill and painted immediately with the scale intact and free of moisture, stood up well in service because of the added protection provided by the mill scale. Since steel in this condition is seldom, if ever, available to fabricators, the results are only of academic importance. They show that the intact mill scale affords protection if dry. If it has been exposed, the best method to artificially simulate the desired surface condition is to flame-prime and paint it as soon as possible. This conclusion is confirmed by Tice (9) in a similar set of tests.

As for the question of sandblasting vs flame-priming, compare the results obtained. It is quite apparent that the flame-primed specimens stood up well by comparison, even when painted with less expensive iron oxide non-inhibitive paint. In fact, these flame-primed specimens stood up better than the more expensive type of paints on sandblasted specimens. This verifies the claim that special paints are not required for use with the process.

It is particularly notable that at the end of one year the red lead and linseed-oil specimens on flame-primed new steel were in perfect condition. The tests also indicated that there is a latitude in the rates of speed used in flame-priming, which will achieve acceptable results. This indicates that recommended practices are more thorough than is actually required.

Among conclusions drawn from this series of tests was the report that " flame-cleaning conducted under the Institute's tentative specification and with considerable latitude in the rate of passage of the flame can give very satisfactory results—results superior in fact to those obtained by sandblasting if the latter is what was employed in these tests." (10)

Applications of Flame-Priming

Practically any metal surface which is to be painted can profitably be flame-primed so as to improve the quality, corrosion resistance, and life of the paint coat. The process is being used to an ever-increasing extent for this purpose, for such important applications as structural steelwork, storage tanks, dams, locks, piling, railroad cars, combat tank hulls, bombs, shells, ship hulls and deck plates, steelwork in subway construction, plane hangars, and pipe lines.

The process received its first wide acceptance in the structural steel industry. Many important bridge structures have been prepared for protective painting by this method, among them being the new International Rainbow Bridge at Niagara Falls. Other important projects of a similar nature include the structural steelwork of overhead parkways, illustrated in Fig. 4.

Another example of the efficient work being done with flame-priming is the new Chicago subway system now under construction. Here the advantages of flame-priming are most pronounced because the structures are virtually dripping with wet rust which has formed in the damp compressed air atmosphere during erection. It is not practical to prime this steelwork prior to erection because of marring in handling through the air locks. The portability of the flame-priming equipment solves the difficulty of cleaning after erection.

Flame-priming also is seeing widespread use in connection with the painting of storage tanks, gas holders, and similar structures. These usually are flame-primed after being assembled and tested. There are, of course, certain exceptions to this practice, such as gas holders of the floating-bell type, in which it is not practical to clean between the bell and the shell after erection. Work of this type is flame-primed at the shop prior to shipment, leaving unpainted a narrow zone on either side of the weld area, to be finished after leak testing.

In the past, storage tanks were often allowed to weather in the open after erection and before painting, to remove the mill scale. For superior corrosion resistance, such tanks are now being flame-primed immediately after erection to preserve as much as possible of the tight scale, the operation taking place, of course, before the tank is filled with flammable contents. This eliminates the unsightly weathering period, permits the entire job to be accomplished quickly at the time of erection, and improves the corrosion resistance as shown by tests and discussed previously.(9)

Some storage tanks which are to be located underground may be more economically flame-primed and painted before shipment from the fabricating shop. In this connection, it is interesting to note how the simplicity and portability of the flame-priming equipment solved a production problem for one fabricator of such tanks. Because of increased production, space inside the shop was at a premium. The simplicity of the equipment and materials needed for flame-priming made possible an unusually efficient setup in the crane yard, adjacent to a railroad siding where the operators had considerable freedom and where handling facilities were ideal. Under such conditions, workmanship was naturally of a high quality.

Pressure vessels likewise may be flame-primed and painted prior to shipment or after installation. In view of the likelihood of the prime coat being marred in shipment, however, it is usually desirable to perform the flame-priming on location. To avoid rusting taking place in transit, it sometimes proves advisable to coat the surface with an inexpensive lacquer to act as a temporary protection and preserve mill scale. This is burned away in the flame-priming operation.

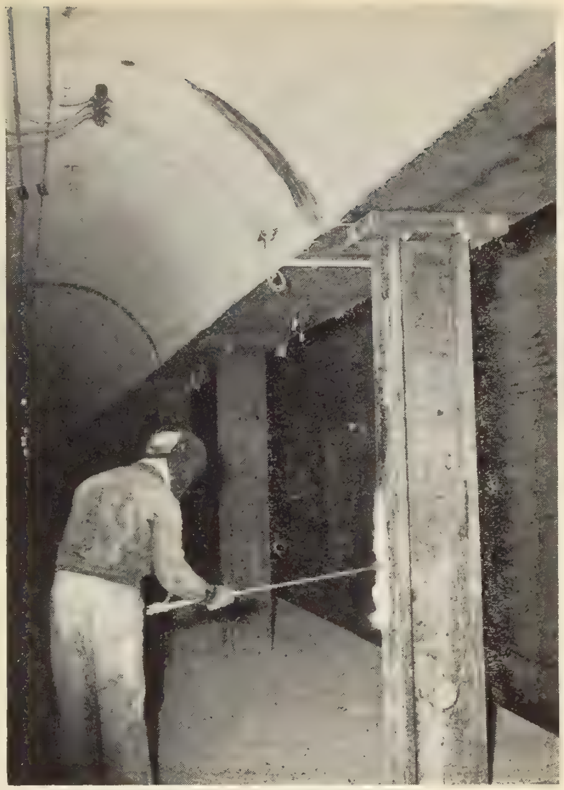

Fig. 5—Flame-priming is practically indispensable for preparing structural steel members in subways where they must be painted after erection in a damp atmosphere. This is a view of operations during construction of the new Chicago subway.

In instances where it is preferred to have the prime coat applied at the fabricators, it is advisable to include "rigger's eyes" in the vessel design so that the work can be handled without damaging the paint during shipment and installation.

Another timely application of flame-priming is its use in connection with aeroplane hangar doors. Flame-priming and painting is carried out at top speed and offers lasting protection and efficient operation in the absence of corrosion. Specifications of the U.S. Navy Bureau of Yards and Docks require the process on underground and waterfront equipment and structures, such as piling, storage tanks, and pipe lines. Flame-priming is ideally suited to this type of work because of its portability which speeds construction under all-weather conditions. During flame-priming even those surfaces that are normally wet from salt spray and high humidity are rendered dry, and remain so until painting. After the piling has been driven, scar marks caused by the driving operation are touched up at low tide by flame-priming and coating.

The U.S. Navy Bureau of Ships has issued specifications for flame-priming steel for ship hulls. Hull plates are treated on arrival at the yard and stored in the painted condition. The weld zones can be painted while still warm from welding or they may be flame-primed just prior to painting.

The process also finds increasing application in the reconditioning of previously painted surfaces that have become badly corroded and pitted, particularly industrial structures subjected to highly corrosive conditions. The action of the flames pops the heavy rust loose even in deep pits and drives off any chemi-

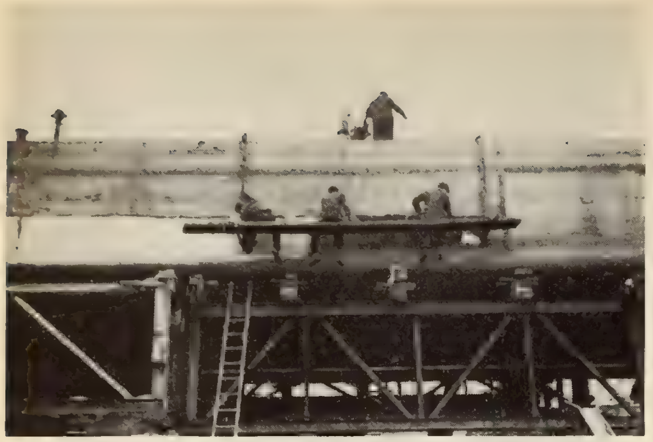

Fig. 6—The bottom of this heavily scaled barge was flame-primed and painted up to the water line, then returned to the river and completed by operators working on a small raft that held all the equipment needed.

cal salts, acids or gases that may be clinging to the surface. Materials, such as pipe that has been underground, are freed of mud and moisture simultaneously.

Boats and barges likewise are flame-primed before repainting. Recently a barge that had been exposed to acid water was docked for maintenance painting. The management of a boat yard, quick to realize the need for removing all traces of acid salts before painting, recommended flame-priming and was awarded the reconditioning project. Figure 6 shows how the bottom of the hull was flame-primed and painted in drydock, and the remainder of the hull completed after the barge had been floated again. The process is now used on practically all work at this yard.

Flame-Priming Operating Data

Visual observation of the reaction of the steel surface under the priming flames is the real index of the correct speed for blowpipe travel. When rust is present, the formation of black magnetite indicates that the rust has been dehydrated satisfactorily. When the reaction is carried one step further and silvery streaks appear in the black magnetite, this is an indication that the flame-priming is even more thorough than is really necessary. When the problem is merely one of removing loose scale, the desired reaction is readily visible in the " popping off " of the scale. The tendency is to do a more thorough job than necessary.

For the purpose of determining the time it would take to do a certain job, estimates of speed can be made. The rates of travel for the blowpipe vary depending upon surface conditions and the type of structure. For example, speeds as high as 50 ft. per min. have been obtained on relatively new I-beams. However, for estimating purposes it is recommended that the conservative figure of about 35 ft. per min. be used. When flame-priming is being applied to thick plates that are heavily scaled, this speed might have to be reduced to about 15 ft. per min. Very wet surfaces must be treated more slowly than those leaving dry rust on them.

A 6-in. flame-priming head used about 137 cu. ft. of oxygen per hr. when operated according to recommendations. If the basic speed of 35 ft. per min. is attained, the head would treat 1,035 ft. per hr. and would use 13 cu. ft. each of oxygen and acetylene for every 100 sq. ft. of surface. On riveted areas, the speed would be about half.

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CANADIAN ENGINEERS' CONTRIBUTION TO VICTORY

GENERAL A. G. L. McNAUGHTON, M.E.I.C.
Chairman, Canadian Section of the Canada-U.S. Permanent Joint Board on Defence

Address delivered to a Joint Meeting of the Detroit Section of The American Society of Mechanical Engineers and the Border Cities Branch of The Engineering Institute of Canada at Detroit, Mich., on October 5th, 1945

Mr. Chairman, Ladies and Gentlemen:

Appreciation for Admission to Honorary Membership

This is the first occasion, Mr. Chairman, on which I have had the privilege of being present at a meeting of the American Society of Mechanical Engineers and I welcome the opportunity to express my appreciation to the president and members for the very great distinction which they conferred on me in September, 1943, in admitting me to honorary membership.

I thank the Society most sincerely for this high honour which I assure you I do indeed value most deeply.

Canada's Part in the Inception, Development, and Production of the Newer and Better Weapons

I am to speak to you to-night about some aspects of science and engineering in the war, particularly with reference to the part taken by Canada in the inception, development, and production of the newer and better weapons and equipments with which to outmatch the enemy in battle and thus to give our troops in combat every possible advantage.

In the course of my remarks I will venture a few observations both on what is past and the difficulties and the dangers which were overcome or evaded, and on what I think the future probably holds; and I will endeavour to draw attention to certain vital matters which I think it is important that we should not again overlook.

It has been shown by experience that, granted time, we have the technical abilities and the physical resources to create the best of armaments. It has been shown, and proved conclusively, that we can have whatever we have the will and purpose to provide. So it is in the realm of policy and direction that we have to be particularly careful.

It is understood, of course, that what I have to say represents my personal opinions only for I have retired from the Canadian Army and, on the conclusion of active operations in the war, my resignation as Minister of National Defence in the government of Canada has been accepted. The only official position which I hold at present is that of Chairman of the Canadian Section of the Canada-U.S. Permanent Joint Board on Defence, which deals with the coordination of general defence matters between our two countries. These matters are, of course, outside the scope of my subject to-night, except that I would like to say to this representative body of engineers from the United States, and from Canada, that I have a very deep sense of the importance of the work which has been entrusted to that Board to our mutual advantage as we go forward side by side into the future and face the great problems which will undoubtedly arise and which will require solution.

The Position of Canada in the British Commonwealth and in America; in Regional and in World Security

War is the continuation of national policy when peaceful means have broken down and so it follows that armament and national policy are very closely interlinked. In consequence the requirements which condition the provision of arms are intimately dependent on the position of the nation in relation to others with which it may be associated.

Canada is a member of the British Commonwealth and she holds to that association with all the firm conviction which has marked the course of our history since early times. She holds to that association, not as any dependent colony of a central authority in London, but as a nation in her own right, happy to co-operate in all matters which make for peace and orderly progress in the Commonwealth, and in the world; but with intention made clear to all that she will make her voice heard in deciding the objects of that co-operation, and that then, she herself, will determine the form and scale of the action she will take—that her decision in these matters, so far as human judgment runs, will be based on the realities of the situation and the best interests of all concerned—her own included.

No one who has ever had close experience of the actual working of inter-Commonwealth relations will question that all matters will be dealt with objectively by Canada, or will doubt that worthwhile causes will be supported; and that the effectiveness of this support, when given, will far transcend anything which might have been considered possible in the older outmoded Imperial form of organization from which our present constitutional position has steadily evolved down the years.

But Canada is also a nation of the American continent and as a consequence we share many interests with you—interests which under modern conditions continue to develop with ever increasing acceleration particularly in matters of defence where, with the remarkable progress in the application of science to war which we have witnessed during the last two decades, distance has lost its former attenuating effect on the problems of international relations. We must realize that continents have now become the geographical units in which most questions, both of peace and of war, must be stated and that effective arrangements for the defence of the territory of one nation has become a matter of vital concern to all other nations of the continent.

There are some who see a difficulty in reconciling our position as a nation on the American continent with our membership in the British Commonwealth, but I do not share this anxiety.

In the first place I believe that fundamentally the real interests of the member nations of the British Commonwealth are very close to those of the United States. In the second place I think we are a practical people ready to deal with each question as it arises on its merits and on the basis of the facts. We see no fundamental reason for conflict in interest and you can be quite sure, with our deep concern for the welfare of each of these great associations of peoples with whom we are so intimately linked, we will devote ourselves on every occasion to promoting unanimity in view.

It is very satisfactory to note that in the steps taken at San Francisco towards world organization provision has been made for developing security on a regional as well as, perhaps more remotely, on a world basis. Both are important and whatever we can do to promote the one will help also in the other.

The Supply Situation in Canada on the Outbreak of War in September 1939

In September 1939, within a few days of the outbreak of hostilities in Europe, Canada declared war on Germany and associated herself with the United Kingdom in the struggle with the Nazis. Mobilization was ordered and before Christmas we had an Infantry Division and other troops overseas in Britain. Apart from clothing, and a few articles of a commercial type, which could be used we depended for equipment on the arsenals there, or on the reserves of armament which had been salvaged from the first World War. Most of these were of obsolescent type.

It was not an enviable position as we soon confirmed that the supplies available in Britain were very meagre to say the least. There was little help to be obtained from Canada immediately for in the interval between the wars we had completely demobilized the munitions industry which had been built up to considerable proportions in World War I.

We had in Canada plans for a rifle factory but it had not been built; we had a contract with a private concern for the manufacture of the Bren Light Automatic; we had a tiny arsenal capable of making small arms ammunition and a few shells annually for practice.

Physically this was about all; and anyone unfamiliar with our country and with its potentialities must have thought that we were very rash indeed to go to war and launch an expedition overseas.

But this was most certainly not all, for while in peace we had been denied the opportunity to develop our arsenals to any reasonable extent, nothing could prevent our thinking about the problem and making plans. We had been able to make a close survey of our manufacturing industries and of our sources of supply for various materials needed. This had shown that our industrial facilities were very widely diversified and highly efficient; that, given time, there was probably no article of war supply which we could not make in adequate amounts for our own purposes with something over for our Allies as well. We had the steel and the coal and the non-ferrous metals and the light alloys which had become of very great importance—we had the nucleus at least of a machine tool industry —we had potentially the labour and the trained mechanics and the engineers.

The problem was one of adaptation rather than of creation and so, granted decision and energy in execution, it could be solved within the time we thought might be available.

Moreover, this was not the unsupported opinion of our military officers alone, for in the summer of 1939 a group of our industrial leaders under the auspices of the Canadian Manufacturing Association had gone abroad and familiarized themselves with possible war requirements; these they were confident they could fulfill.

So also in the vital matter of the application of science to design and production for war the unique facilities of our National Research Council had been geared into our Defence departments and were available to undertake the tasks required with many of which the technical staffs were already at least partially familiar.

Further, as an added reason from which we could draw confidence we had the factual record of the immense results achieved in the production of munitions in Canada during the first World War once the dead hand of absentee control had been suppressed and the initiative of our manufacturers had had some freedom to express itself.

It is true that our production then had been primarily confined to the simple types of gun ammunition, training aircraft, and the like and that we had been content to take the designs and specifications which had been given to us from England; but a study of the history of this effort had shown up some very significant facts which were most encouraging for the future.

In the first place, it was clear that the application—even to the limited extent permitted—of the North American technique of mass production had increased the rates of output manifold over what had been expected under the methods of British industry then current; the costs as measured in money or in man hours had been decreased very remarkably.

In the second place, in the most important matter of quality the record had been superb; and further in the later years when the industry had got well underway there was clear evidence that our engineers had not rested content with the routine of production but had shown initiative and inventive capacity of a very high order.

Before the First Division sailed from Canada contracts had been placed for all the motor transport required; designs and proto-types were available. Here, in this city of Detroit which is so closely associated with our own motor industry, I wish to pay my tribute to what was accomplished. By the early spring of 1940 when we were due to cross from England into Europe to join the British Expeditionary Force under Lord Gort's command the many thousands of vehicles required had been delivered to us overseas mostly from our own plants in Canada. Going on from there throughout the war we received in an unending stream new designs quickly evolved to meet new needs as they became apparent.

I say to the men of the Canadian motor industry, and to you here who have helped us so much, that this early performance was most heartening and encouraging—it was right up to expectations, not only in the quantities delivered, but even more important in the excellence of the product.

I wish I could say the same for other matters of supply but in most things before these could be arranged those in authority overseas seem to have got the idea of a "phoney war" and there was delay and apathy in placing orders which was not broken until the rude shock of the fall of France brought everyone to their senses and to realization of the dire peril in which we stood. Then Canada really did get going.

The Period of Improvisation in Britain for Defence

Overseas meanwhile we had managed to get the First Division fairly well equipped but with the greatest difficulty and we certainly had enough experience with obsolete and unsatisfactory armament to rub in the lesson of the need of new and more appropriate designs; but in the imperative necessity to give all attention to organization and to training there was little that we could do to improve matters at that time.

In the battle of France we had one essay across the Channel when we were sent to support an army which did not exist except in the imagination of a crumbling government and then we had to withdraw with more haste than dignity.

In the retreat from the continent of Europe the British Forces had lost most of their equipment, armament, munitions and reserves and there was very little available in the United Kingdom for the reason that during the " phoney war " most things had been sent forward as they were made to depots in France and these had been overrun before they could be moved.

In the Battle of Britain, even in rifles, we were to begin with tens of thousands short for the actual numbers of men in the units. So perforce we were driven to improvisation.

There were few anti-tank guns so we had to imitate David but the missiles to be thrown were not " the smooth stones out of a brook " with which he had disposed of Goliath, but bottles of phosphorous and naphtha which burst into hot flame spontaneously on impact. I recall the great search made through the ancient manuscripts in the Bodelian Library at Oxford to ascertain the exact composition of Greek Fire which had last been used decisively in 1100 when Alexius of Constantinople routed a Pisan fleet by its use.

There were few anti-aircraft guns so A.A. mountings had to be improvised for light and medium machine guns and for field guns; and so on throughout the whole range of requirements.

We did not possess the modern weapons needed so something else had to be found to take their places. Explosive obstacles to surprise and destroy enemy tanks—trip-wires to wreck enemy planes and gliders attempting to land on any areas where this form of attack was thought likely—the whole business was very primitive indeed.

Even guns which dated back to the era preceding the South African War which had been placed in store by the thrifty Admiralty were taken out and pressed into use mounted on commercial vehicles of sorts with boiler plates for armour. They may not have been very effective but in their utter ugliness they looked formidable and that was something.

With great truth, through the long days of the summer of 1940, Britain was held largely by bluff for it is difficult to believe that any serious attack from across the Channel could have been effectively resisted.

I have mentioned these experiences to give point to the lesson that no nation can ever afford to neglect its armament. By being deluded into this path after World War I the Allies very nearly lost the last opportunity to redress the balance in Europe and so begin the series of great campaigns which finally brought us to victory. Certainly no Canadian who was there will ever forget this experience and I hope that the lesson will be well remembered by those who now have the duty to show pre-vision and who have the power to act.

The Period of Preparation for the Renewed Offensive on the Continent of Europe

Through all the summer of 1940 reinforcements came to us from Canada across the wide spaces of the North Atlantic as fast as ships could be found to transport the men and move their supplies. By the autumn the forces in the United Kingdom had grown to considerable dimensions and both British industry, and our own with your good help, were making the most strenuous efforts to correct the deficiencies in equipment and armament. By the early winter we could feel that Britain was a bridgehead over against the continent of Europe, reasonably secure, in which the vast potential forces of North America could be assembled in due course and we had FAITH that in proper time and season our sister nations on this continent would join us in the struggle.

We could lift our eyes from the immediate pressing problems of defence and contemplate again the time when we might strike back in Europe itself; when we could meet the enemy there again in open battle to seek a decision which would bring about his final defeat.

We could lift our eyes and give our thoughts to the plans and preparations that needed to be made. We could think out what we should do in order to make the best use of all the great abundant advantages which we had—or could have if we had the wit to turn them to account.

And what are these great inherent advantages for the making of modern war which are characteristic of the North American continent—both of Canada and of the United States!

Our young men are highly educated and naturally familiar with mechanism in all its varied forms—intelligent, resourceful, full of initiative, and responsive to leadership.

Great home countries are in active process of bringing their vast natural resources into use and engineers are skilled in the art and accustomed to the conduct of projects of the greatest magnitude.

Mass production industries of great variety, and most comprehensive, can take a new design and rapidly turn it out in any numbers needed and with the high precision which is required in the weapons and apparatus of modern war.

Industrial leaders of vision and resource are trained in the hard school of a developing economy—raw materials in abundance—with wide experience in engineering, in research and in developments of many kinds.

What we needed for the European attack was the most highly mechanized army which could be created, equipped, and trained in the limited time available before this great endeavour could be launched. Certainly in 1941 we had at least two years; quite possibly more.

We needed armour and engines for employment in the field. We needed new and better mechanical vehicles to give us facility for rapid movement and to transport great masses of equipment over great distances. We needed new and better weapons of greater power and range and more precision in the accuracy with which they could be directed on the vital points within the enemy's dispositions. We needed new and better propellents for our guns. We needed new explosives of more intense character to shatter the enemy's fixed defences of concrete and steel and to penetrate the heavy armour of his tanks and other fighting vehicles. We needed better cameras and optical equipment to detect and locate his works for defence and offence and overcome his camouflage. We needed better gear to track his aircraft and bring effective gunfire against them in the few split seconds that they might be engaged. We needed means to create new airfields with the utmost rapidity close up behind our advancing armies so that they could continue to enjoy that intimate air support which had become essential. We needed docks and wharves to turn an open beach into a port and bridges to cross the many large rivers that lay across the path of invasion into Germany. We needed amphibious vehicles to facilitate the landing and the negotiation of streams and swamps and other water obstacles. We needed to ceaselessly experiment with all this new gear to work out and evolve the form of organization and the methods which could best be used.

We could spend material in the most generous profusion to bring about the enemy's defeat and it was right to do so to save the precious lives entrusted to our care.

Much of this great work of experiment and development had gone on in the Canadian Army as opportunities were made throughout the period of the Battle of Britain. There had been the closest co-operation with the various British authorities and with their encouragement progress of considerable value had been achieved in many lines which we had undertaken as our share in the general effort.

For the supply of the vast assortment of the material required we had to look principally to North America. The factories of Britain were under air attack and subject to serious interruption.

Available labour was scarce and urgently needed for maintenance and other purposes and, most important, we had learnt from hard experience that designs worked out in the British industrial environment were often unsuitable for mass production according to the North American technique. Screw-threads differed—rivets spaced for insertion by hand could not be placed with our automatic machines—and we literally could not do in quantity the elaborate hand fitting which was the customary practice in the British Isles. Even technical terms had different meanings on either side of the Atlantic and some there who were opposed to new devices for they threatened the supremacy of established interests.

It was necessary therefore, if unfortunate delays were to be avoided—as they had to be—that detailed designs should be developed at home and that those who were overseas should content themselves with giving the general idea of what was wanted together with the most complete "user specifications" that they could define.

By early 1942 we were in the closest touch in the United Kingdom with representatives of the American Army and the results of all our trials and experiments were given to them without reserve. In return we had their welcome collaboration and their valued advice and help.

In Canada the need for newer and better weapons had also been recognized; an organization for development had been established and great efforts were being made to translate our requests into models with which we could experiment. Here too the closest touch had been established with the U.S. Army and with U.S. industry so that all facilities might be developed for the common purpose without duplication or waste of priceless time and effort.

In the tank, for example, our engineers in Canada took the M.3. and from it evolved the Ram, which in its turn contributed to the M.4., the Sherman, the tank which we used with every satisfaction in operations from 1943 onwards. We had well founded confidence in it, for we knew that it incorporated the features to which we attached special importance and we had had the opportunity to test and comment on its performance from the days of the earliest models.

As another example of the close association between Canada and the United States which came about I mention radar. Our National Research Council had been early in the field with the C.R.D.F. and some purely scientific investigations on the height of the Heavyside layers and this gave the background for immediate progress when early in 1938 the suggestion came from England of the vital importance of tracking enemy aircraft while yet they were at great distances so as to have early warning of attack. As a result we were able during 1941 to develop a design of reasonable performance and in 1942 we had the great satisfaction of turning over a considerable number of these sets to the U.S. Army for their use at a time when the requirement was very critical. I can assure you we were very happy indeed to make this contribution in what was then a very new and novel art.

The radio fuse is another example of the flexibility and co-operation between our two countries which came into being. The first developments in Canada were started at the University of Toronto in 1940 and the early activities of our two countries were closely co-ordinated later as it became evident that the special and extensive facilities required for rapid progress were to be found only in the United States. The Canadian effort was restricted to a few special phases of the problem and the Canadian scientists who had been working on it came under American direction.

In the mechanization of flame warfare—in new methods to smash armour — in new ways to pass through minefields—and in countless other matters of great import the story is the same.

A case of special merit is exemplified in the organization for the study of chemical warfare and of the other similar methods to compel an enemy to comply with our will. The Canadian and the U.S. laboratories were hardly distinguishable from one another and the staffs from one country moved without restriction in the establishments of the other and common use was made of all the testing grounds and other facilities wherever located.

I have mentioned these few examples from among the many to show the close integration which had been achieved in the development of war equipment. In the result and thanks to mass production, and the most careful standardization, our armies were given in full supply the best that could be devised of everything required.

For the invasion of Europe they were the most perfectly equipped of any armies which had ever gone to war. They had attained the highest standard in the application of mechanism to ease the task and multiply the power and speed and range of man—to conserve life and to aid and facilitate the completion of the tasks which had been entrusted to them.

Lend Lease and Mutual Aid

Not the least of the matters of importance in connection with the arrangements for the equipment and maintenance of the Armies, both yours and ours, has been the method by which the financial costs, running into astronomic figures, have been met.

We each have had the problems not only of paying for everything which our own armies required across the whole range of costs from guns and aircraft to clothing, food, and medical supplies—but we also have had the problem of providing for the costs of what we placed in the hands of Allies for their armies, and for their civil populations as well, so that they might be enabled to do their part without the accumulation of continued debts which could not be liquidated and which would embarrass both them and us in the period of post-war reconstruction.

You solved this problem by "Lend-Lease" and we by the similar procedure of "Mutual Aid." It is a source of great satisfaction that Canada's effort in these matters has been entirely self financed. We accepted no monetary aid from anyone and on our part we saw to it that no burden of debt was placed on those we sought to help.

The measure of this help, which we were glad to give and bear, runs to amounts expressed in thousands of millions of dollars—amounts which have been, or will be, met by the thrift and savings of the Canadian people both during the war and in the period which now follows.

And so at last we come to Victory, decisive, all embracing, and complete, and in this long sought result the scientists and engineers of both our countries and from Britain across the sea—the men responsible for design and production—can take the greatest satisfaction in the contribution which they have made. We started with very little and in a position far inferior to our enemies. We quickly overtook and then surpassed them, not only in the equipment actually in use, but in every new line which they had visioned into the future.

As one who watched these matters with close attention, and very anxious interest, throughout the war, I express my sincerest admiration at the achievement.

Conclusion

The note on which I wish to end is not one of complacent content, for in the world to-day we cannot afford to rest. We have gained victory but it is yet to be confirmed through the organization of security and of the will to use force, if needs be, to maintain peace. It is a vital requirement that the Allied Nations who think with us remain collectively the strongest military force on earth, and each and every one of us must make our contribution to this end.

We have entered, and are far along, into the period of the application of science to war and the rate of acceleration makes the arms of today of lessened value for tomorrow. Already we have the atomic bomb, a decisive weapon in this year and day of grace, but it as well represents nothing more than a transient advantage unless we maintain our lead; for the means to counter are already clearly in sight.

If we are to retain our place as the wardens of peace the most important thing we have to do is to maintain our research and development, to continue to produce the newer and the better weapons, at least in prototype, and to ceaselessly experiment to master the technique of their employment.

In this great task I earnestly hope that Canada and the United States will long continue the satisfactory and fruitful collaboration which they have achieved in these matters.

WHAT IS AN ENGINEER?

An answer to this question, and to other relevant questions, was prepared in New York on August 28th, by a group of engineers representing the four Founders Societies and eight other organizations, including the Dominion Council.

The conference was called to consider changes to the United States Model Law for the Registration of Professional Engineers and Land Surveyors. The principal specific objectives were to find an acceptable definition of "Professional Engineers" and "Practice of Engineering".

The conference agreed on the following definitions—

Professional Engineer:

"The term "Professional Engineer" within the meaning and intent of this Act shall mean a person who, by reason of his special knowledge of the mathematical and physical sciences and the principles and methods of engineering analysis and design, acquired by professional education and practical experience, is qualified to practise engineering as hereinafter defined, as attested by his legal registration as a professional engineer".

Practice of Engineering:

"The term "Practice of Engineering" within the meaning and intent of this Act shall mean any professional service or creative work requiring engineering education, training, and experience and the application of special knowledge of the mathematical, physical and engineering sciences to such professional services or creative work as consultation, investigation, evaluation, planning, design, and supervision of construction for the purpose of assuring compliance with specifications and design, in connection with any public or private utilities, structures, buildings, machines, equipment, processes, works, or projects. "A person shall be construed to practise or offer to practise engineering, within the meaning and intent of this Act, who practises any branch of the profession of engineering; or who, by verbal claim, sign, advertisement, letterhead, card, or in any other way represents himself to be a professional engineer, or through the use of some other title implies that he is a professional engineer; or who holds himself out as able to perform, or who does perform, any engineering service or work or any other professional service designated by the practitioner or recognized by educational authorities as engineering".

There were other amendments to the Law which were agreed upon, but they are of less importance than the two definitions. The decisions of the group are to be submitted to the governing bodies of the various societies.

Readers will be interested in the proposal to make legal registration the sole qualification for recognition as a professional engineer, as described in the engineer definition. If registration is to mean what it was intended to mean this seems like a logical move, but there is evidence that not all persons see it that way. It will be interesting to see how the societies receive the recommendations.

MORE ABOUT CIVIL SERVICE SALARIES

For a long time *The Engineering Journal* has been pounding away at the salary scale paid to members of the profession by the federal civil service. It was very encouraging to see, recently, in the *Ottawa Citizen*, an editorial, on the same subject. Under the heading "Why Men Leave Home", the *Citizen* lays bare the situation in Ottawa, all of which would be of more than passing interest to the Department of Finance and the Treasury Board.

The editorial quotes half a dozen cases that to the casual reader would seem almost too fantastic to be true. Here they are — One is a B.Sc. of British Columbia and an M.A. of McGill who receives a salary of $3,180, after 19 years' experience. Another is both a B.A. and an M.A., with four years' experience and an $1,800 salary. A third is a graduate of Manitoba, with an M.Sc. from Cornell; he has had three years' service, and he receives the munificent sum of $1,620 per year. One man with a B.A. from McGill, and an M.A. from Wisconsin, and a D.Sc. from Edinburgh, with fifteen years' experience, draws a salary of $3,180, and there is another with a Ph.D., a B.A. and an M.A., who has had six years' experience, and receives from His Majesty's loyal government the sum of $2,160.

Not long ago, a young engineer, working in one of the research departments, gave the *Journal* an outline of a situation wherein a dozen engineers and scientists, who made up the entire technical section of the department, were preparing to go with outside interests, because they were not getting a fair wage. The work in this department is of great importance, yet it looks as though the government were willing to let the entire organization slip through its fingers, for no other reason than that it is not prepared to pay a decent wage.

How can the heads of departments operate with the efficiency they know is essential to success, if they are not able to acquire or retain professional and technical personnel on their staffs? How can the government meet its post-war obligations if it cannot obtain the technical persons necessary to it? There is a great scarcity in Canada, as there is elsewhere, of well qualified technical personnel. Great numbers have been assembled in Ottawa for war work. Many of them have accepted their positions and remained at them purely because of their loyalty to the country. Now the war is over this consideration has disappeared, and before long the personnel will have disappeared also, as far as government service is concerned.

Job Openings Scorned

In the employment office of the Institute there are frequent demonstrations of the fallacy of this government policy. Daily ten to twenty persons examine the list of openings that are on file with the Institute, but none express any interest in the government openings. Why should they? Right alongside are other offers from industry which afford from twenty-five to a hundred dollars a month more for the same qualifications.

Recently, the Institute informed the Civil Service Commission that it was unable to supply applicants at the wages offered — that it was useless to put the notices on the board — or the advertisements in the *Journal*. And yet, everyday the employment service is finding men for other employers. How long does the Treasury Board propose to continue this farcical procedure? The madness of government policy seems apparent to everyone except those who are responsible for it. Can't something be done before it is too late?

EXAMINATION CHANGES

Upon the recommendation of the Board of Examiners, Council at its last meeting agreed to do away with its examinations for entrance to the Institute. Henceforth it will be recommended to candidates who do not meet the requirements for entrance without examination that they make application for membership in the provincial registration body of the province within which they reside. At the same time assurance will be given that their acceptance by that body will be taken by the Institute as meeting its requirements.

This decision has been reached after long consideration. The fact is that there are not enough candidates of this type to warrant the expensive and wasteful duplication of examining boards, right across Canada. The associations are required by their Acts to maintain the examination system, and therefore it is logical that if one is to be discontinued it should be the Institute's.

This move should go a long way towards smoothing out the few differences that still exist between the two types of organization, and to promote uniformity of recognition of professional qualifications.

THE NAVY SPECIFIES ENGINEERS

Naval Service Headquarters, Ottawa, announced recently that an Electrical Branch is being formed whose officers will be professionally qualified electrical engineers or physicists.

The new Electrical Branch will be responsible for all technical work associated with development, manufacture, installation and maintenance, both ashore and at sea, of all electrical equipment. This is a large and complicated field, and the experience in the recent war showed that, to produce best results, the old combination of executive and technical duties must be separated. There is still provision for promotion from the "lower deck". The new service will be identified by a dark green stripe between the gold stripes of rank.

Engineers everywhere will be gratified to know that the Navy has recognized the special qualifications of the profession. For too long, technical appointments in the services have gone to persons without technical qualifications. It is hoped that the example set by the Navy will be followed by the other services within a reasonable length of time.

EXPANSION OF SCIENCE FACILITIES

The universities of the United States are planning an elaborate programme of expansion in their science departments, according to a recent newspaper release. The Montreal *Gazette* of October 23rd gives a great deal of information from a survey of 25 institutions of higher learning made by the *New York Times*. This news is of interest inasmuch as nothing comparable has been announced in relationship to Canadian universities. Perhaps it is too soon yet to expect such announcements. It may be that the inspiration from the proposals in the United States may encourage Canadian authorities to adopt a similar policy.

The survey shows that more than $50,000,000 is to be spent by the 25 institutions, during the next few years, on the construction of science buildings, laboratories, equipment and technical material. An average of $2,000,000 per institution is substantial.

The *New York Times* gives credit to the atomic bomb and nuclear physics for the sudden development of interest in the expansion of science facilities. In recent months there has been a lot of news printed about the atomic bomb, some of it rather confusing, but if it prompts institutions and individuals to devote large sums of money to an expansion of studies in engineering and science, it will have served a useful purpose.

Facilities for every branch of learning in Canadian universities are overcrowded, and could do with a substantial improvement. This is particularly true in science and engineering. It is to be hoped that the provincial governments, which are largely responsible for financing our Canadian universities, will not place them under too great a handicap in relationship to sister institutions across the border by not equipping them adequately in these most important fields. Large appropriations for expansion of this kind should receive very solid support from the general citizenry.

GREETINGS FROM LIBERATED NORWAY

Telemark, Veikontov,
Skien, Norway.
October 3rd, 1945.

The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal, Que.

Dear Sirs:

The war is over, and I would be glad to take up my membership again with the Institute. At the same time would you kindly insert in the *Journal* the following:

To the members of the Institute and to all the Canadian people.

In this way I want to extend to you my congratulations for the Victory in the recent war. Also receive my heartiest thanks for what you all have done to liberate Norway.

Yours sincerely,

(Signed) O. H. Tjonnaas, M.E.I.C.

E.C.P.D. ANNUAL MEETING

An event of unusual importance to engineers, that takes place each year unknown to most engineers, is the annual meeting of the Engineers' Council for Professional Development (E.C.P.D.). As annual meetings go this is a small affair, only about thirty to forty delegates being present, but it is no small affair to the profession. To this meeting come leading thinkers—educationalists, industrialists and consultants—to review the work of one year and to plan the work of another, so that engineers in the United States and Canada may participate in " the development of a system whereby the progress of the young engineer toward professional standing can be recognized by the public, by the profession, and by the man himself, through the development of technical and other qualifications which will enable him to meet minimum professional standards ".

" E.C.P.D. is a conference of engineering bodies organized to enhance the professional status of the engineer." It is made up of eight organizations, seven in the States and one in Canada. They are——American Society of Civil Engineers — American Institute of Mining and Metallurgical Engineers—The American Society of Mechanical Engineers—American Institute of Electrical Engineers—The Society for the Promotion of Engineering Education—American Institute of Chemical Engineers—National Council of State Boards of Engineering Examiners—The Engineering Institute of Canada. The annual meeting held in the engineering societies building, New York, on October 19th and 20th, marked the beginning of the thirteenth year of fruitful cooperation.

The Council has four main or permanent committees and three special committees. They are, in the order mentioned, with the Institute representative—Committee on Student Selection and Guidance (L. F. Grant)—Committee on Engineering Schools (none)—Committee on Professional Training (C. R. Young, J. W. Brooks, Alphonse Ouimet)—Committee on Professional Recognition (J. A. Vance)—Committee on Information (L. A. Wright)—Committee on Engineering Ethics (C. R. Young)—Committee on Employment Conditions for Engineers (R. E. Heartz). The Institute's representatives on the Council are C. R. Young, C. J. Mackenzie and de Gaspé Beaubien, C. R. Young being the executive member.

At the meeting each committee presented its annual report. It would be a splendid thing if every member of the Institute could read them. There is no other way in which the work of E.C.P.D. can be fully appreciated. Following the custom of previous years a copy of the complete report will be mailed by the Institute to every councillor, branch chairman and secretary-treasurer, to every university president, dean of engineering, department head and librarian. Copies go also to the officers of undergraduate engineering societies, and to sister organizations throughout Canada.

It is not practical to send a copy to every member, but to keep the members informed and to give a widespread distribution to the information, each report will be reviewed herewith. E.C.P.D. is unique in the history of engineering development. Engineers should follow its deliberations and its decisions. They point the way to the attainment of that professional status to which all engineers aspire.

The Chairman Reports

Everett S. Lee of the General Electric Company is chairman of E.C.P.D., and was re-elected to that office for 1946. His report was the basis of his address before the annual dinner, and was made up largely of a review of the work and attainments of the committees. As the *Journal* proposes presenting the work of the committees in greater detail than it was possible for Mr. Lee to do in his report, it is not the intention to reproduce his address here, but his closing sentence should be repeated because it is both a challenge and an inspiration: "And to all I say how glad I am to be an engineer—and I trust and pray that each engineer so sees his chosen profession that he recognizes its great fundamentality, its great achievements, its great potentialities, and that he will give of his time and abilities to making those potentialities into his concept of their realities."

Student Selection and Guidance

As part of the work of this committee a most interesting report was presented by Dr. K. W. Vaughn of the Carnegie Foundation on the selection and guidance tests which are being conducted under the joint auspices of the Society for the Promotion of Engineering Education, E.C.P.D. and the Carnegie Foundation.

For the first time tests were applied to Canadian students (at the University of Toronto) bringing the total of participating colleges up to 25, and the number of tested students up to 4,900. Through other institutions and agencies, including returning veterans, another 9,000 have been tested. The results are classified in considerable detail and out of it all Dr. Vaughn paints the picture of the typical freshman.

" The general characteristics of engineering students presented in this report have significance. Preliminary study to test results indicate that many of these factors bear directly on the success of individual students in the college of engineering. As we learn more about these factors and are able to relate them to student ability and accomplishments, examination techniques and guidance functions can be greatly strengthened and improved, thereby improving the whole process of engineering education."

With regard to the " guidance " portion of the committee's work, the report indicates that the returning serviceman provided the field for greatest service. Contacts were made with government agencies of all kinds in order to place the E.C.P.D. material where it would do the most good. It became evident that counselling had to be done on a local or personal basis. The report says "Although information and referral centres, and selection and guidance centres have been set up formally under government auspices, the average soldier with his experiences in the Army and with governmental controls fresh in his mind wants to secure information which is personal and given by people he knows and in whom he has personal confidence. In the setting up of informal centres and many formal ones, such as V.A.P., high school guidance personnel was very much in evidence. Even more important than this, there is

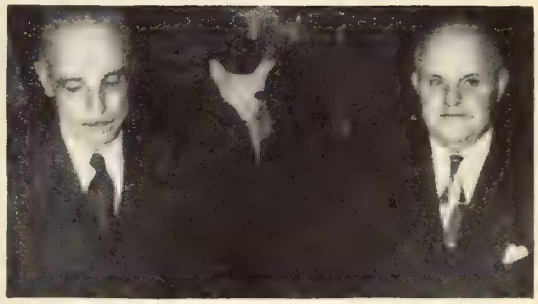
Chairman Everett S. Lee; Dr. de Gaspé Beaubien, past-president of E.I.C.; Dean R. L. Sackett, assistant secretary of A.S.M.E.

George Stetson, editor of Mechanical Engineering; J. S. Thompson of McGraw-Hill; H. E. Wessman of New York University; Dr. A. R. Cullimore, president of Newark College of Engineering; Dr. E. H. Colpitts, director of the Engineering Foundation.

G. W. Bower, H. H. Henline of A.I.E.E., Admiral R. E. Bakenhus, R. E. Goetzenberger.

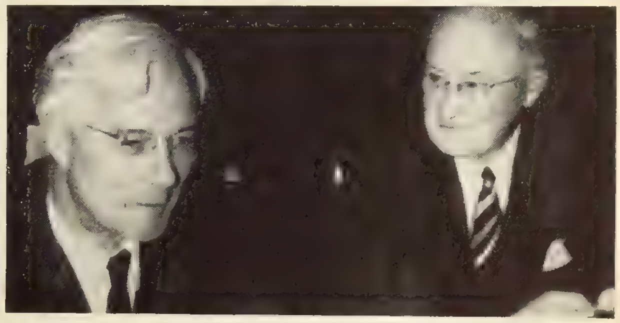
Dean C. R. Young of E.I.C. and Ole Singstad, consulting engineer of New York.

H. S. Rogers; C. B. LePage of A.S.M.E.; W. F. Ryan; Dean Geo. F. Bateman of Cooper Union, New York; Jno. Sengstaken, Western Precipitation Company, New York; W. A. Carter of Detroit Edison Company.



S. L. Tyler, secretary, and S. D. Kirkpatrick, past-president of the American Institute of Chemical Engineers.

J. W. Brooks of E.I.C.; F. W. Stubbs, Jr., of Rhode Island State College; Col. L. F. Grant of E.I.C.



Dr. D. B. Prentice and C. C. Knipmeyer, both of Rose Polytechnic.

J. A. Vance and Dean C. R. Young of E.I.C.; J. H. R. Arms, secretary United Engineering Trustees.

A. B. Parsons, secretary of American Institute of Mining and Metallurgical Engineers, A. F. Greaves Walker, and W. B. Plank of Lafayette College.

that unofficial help which a soldier asks from those in his own community with whom he is acquainted ".

The committee warns of a great shortage of engineers, or a " deficit " as the report puts it. It says in part " For the purpose of preparing a conservative estimate of the probable demand for engineers both in the immediate future and in the early years of the post-war decade, it would seem to be substantially true that:

> " The earliest possible date for graduating sufficient engineers to meet the demand of a current year is in 1948. It is estimated that a total of 16,000 engineers will have to be graduated in 1948 if we are to meet the *current* needs of that year. In order to graduate these 16,000 engineers in 1948 it would be necessary to enroll approximately 30,000 freshmen during the remaining months of 1945 and to train them on an accelerated programme. This would meet, remember, only the current demand of that particular year—a demand which is comparable with the demand of pre-war years.
>
> " It is also quite evident that the deficit in engineers which has resulted from induction procedures in the years 1943-48 will accumulate an added deficit of many thousands of engineers. To the *current* deficit in 1948 there would be added a cumulative deficit in the years 1943-48 of approximately 30,000 engineers. This would give a total deficit in the year 1948 of 46,000 engineers which would have to be built up if we were to be in the same position that we were at the outbreak of the war. This deficit of engineers translated in terms of prospective freshmen would mean that while in normal years we might take in 25,000 freshmen, we would have to take in this year 90,000 freshmen. It would be interesting to note that this is 65,000 in excess of our normal intake of freshmen in pre-war years."

These statements reflect credit on the Canadian war policy of encouraging students to complete their courses. During the war years the number of engineering graduates in Canada was not reduced. This places Canada in a happy position as compared to the States, where no medically fit young man was allowed to stay at college beyond 18½ years of age. The report finishes with this paragraph—" Guidance really indicates a little longer contact with the person to be guided. We think of a guide as one who helps with plans for a journey; one who may test either formally or informally as to capacity to stand the experience; but a good guide goes *along* with you until you are at least in sight of your objective. It seems to the chairman of this committee that some definite interest shown by professional engineers in the developing of responsibilities of the young engineer while in college is very much to the point. It would be much more effective coming from the Council and a group of this character than from any professional group definitely limited to the teaching profession ".

Accrediting of Engineering Schools

This is the one portion of E.C.P.D. work in which the Institute has not participated. It relates to curricula of American institutions only, but there is one note in the chairman's remarks which may have significance to Canadians. He says "Although the inspection of schools in Canada would of necessity be postponed until after the immediate war period, the committee considers that it would be advisable for Council to authorize a request to The Engineering Institute of Canada to recommend a member of this committee."

With the publication of this year's list, the number of curricula examined becomes 683. Of these 74% have been fully accredited, 11.5% provisionally accredited, 14% not credited and 5% pending. In the States there are 167 engineering degree granting institutions, of which 143 have been inspected by E.C.P.D. at their own request and at their own expense. This is a great record of work accomplished.

The newest work of the committee is the accrediting of technical institutes, which is just now under way. It will surprise many Canadians to know that the committee has record of 245 such institutes in the States. This is made up of technical institutes offering terminal technical programmes, including endowed institutes, junior colleges, state and government supported schools, Y.M.C.A.'s, industry programmes and correspondence schools.

To Canadians another interesting feature of the report, which is referred to but briefly, has to do with the educational requirements for appointments to the civil service for veterans. It seems that under the Veterans Preference Act it may not be required that the applicant have the customary academic status to secure an engineering position.

This committee has accomplished one of the greatest tasks ever done for the stabilization of engineering education. In ten years the ground has been covered adequately, so that the " buying " public could tell which institutes were up to standard and which were not. At the same time the inspections aided many colleges in raising their own levels to meet the competition and the needs of the profession.

Principles of Engineering Ethics

Gradual, if slow, progress was reported by this Committee, on which the Institute has representation. Approval of the proposed canons of ethics, either wholly or with small modifications, has been given by the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Institute of Consulting Engineers, and the Society for the Promotion of Engineering Education. No final action has been reported by the American Society of Civil Engineers, the American Institute of Chemical Engineers, the American Institute of Mining and Metallurgical Engineers, the National Council of State Boards of Engineering Examiners, or The Engineering Institute of Canada.

Considerable discussion took place at the meeting respecting the desire of certain American engineering organizations for admission to E.C.P.D. as constituent bodies. The Council requested the Chairman to appoint a committee to review the situation and report on a possible programme of more extended participation of related societies, having full regard to the Charter and the Rules of Procedure.

Annual Dinner

At the annual dinner, President A. R. Cullimore, of the Newark College of Engineering, the retiring Chairman of the Committee on Student Selection and Guidance, gave an outstanding inspirational address on the subject of the returning veteran. In graphic language, with a wealth of incident growing out of long personal experience, Dr. Cullimore made it clear that there is little justification for considering any veteran as other than a normal person. Whatever disability he may have should and can sooner or later be played down below the level of consciousness.

Dr. R. L. Sackett, retiring Secretary, spoke in a statesmanlike vein of the future of E.C.P.D. He expressed the view that adult education had been far too little explored as a means of improving and developing engineers. Much is to be learned in this connection from the experience of the Armed Forces Institute.

The representatives of The Engineering Institute of Canada expressed the wish that E.C.P.D. might hold its next Annual Meeting, or one in the very near future, in Canada, and invited the Council to do so. The suggestion was received with warmth and it is possible that it will be accepted for the meeting in October, 1946.

CONGRATULATIONS TO THE QUEBEC CORPORATION

On November 24th of this year the Corporation of Professional Engineers of the Province of Quebec celebrates the 25th anniversary of its founding. The celebration takes the form of a banquet, at the Mount Royal Hotel, with Harry E. Nold, president of the National Society of Professional Engineers (U.S.A.) as speaker.

Twenty-five years in the life of an individual or organization is an important segment of a full life span, but it is particularly so in this instance when the accomplishments of the quarter century are considered. The Corporation has come a long way. It has survived the early years of trial and tribulation and in twenty-five years has reached a stature of which its officers may be proud. To-day it stands strong, and ready to reach out for another twenty-five years of essential service to the engineers of the province.

The Corporation was established in 1920 along with similar bodies in British Columbia, Manitoba, Alberta, New Brunswick and Nova Scotia. All provincial Acts were based on the Model Act which had been developed through a period of three years by the Engineering Institute. In Quebec and Manitoba, the new Acts superseded Acts passed in 1898 and 1896 respectively, under which membership in the Institute was the requirement for permission to practise.

The Engineering Journal of July, 1920 reports the first meeting of the Corporation, from which the following is extracted:

" The first meeting of the Corporation of Professional Engineers of the Province of Quebec was held at the headquarters of The Engineering Institute of Canada, 176 Mansfield St., Montreal on Thursday, May 27th, 1920. The meeting was a lively one with considerable discussion. The majority of members wished to elect the provisional council, which had undertaken all the work of preparing the legislation authorizing the incorporation of the association and compiling the by-laws as the first formal council of the corporation. A small minority objected to this and this objection led to several amendments being suggested and a proposition that the nominations be thrown open to a vote by ballot. The amendments were voted down one by one and eventually the provisional council was elected by a very large majority for the ensuing term as the first council of the new Corporation of Professional Engineers.

" It was decided to elect a council of eight members, five from the district west of Three Rivers, and three from that east of the same city, chiefly from Quebec City. The following members were elected:—West of Three Rivers:—Arthur Surveyer, M.E.I.C., W. F. Tye, M.E.I.C., Walter J. Francis, M.E.I.C., K. B. Thornton, A.M.E.I.C., and Frederick B. Brown, M.E.I.C., of Montreal. East of Three Rivers:—A. R. Decary, M.E.I.C., A. B. Normandin, A.M.E.I.C., and J. Gibeau, A.M.E.I.C., of Quebec City. A. R. Decary of Quebec City who had presided over the deliberations of the provisional council, presided at the meeting with Frederick B. Brown as Secretary. Mr. Decary recounted the work done during the past year for the organizing of the Corporation of Professional Engineers of the province, affiliated with The Engineering Institute of Canada, with headquarters at Montreal. The Act, he said was simply transferred from The Engineering Institute of Canada to the new Corporation of

Professional Engineers, making the usual provisions for membership and by-laws.

"At a subsequent meeting of the council the following officers were elected:—President, A. R. Decary, Quebec; Vice-President, Walter J. Francis; Honorary Secretary-Treasurer, Frederick B. Brown.

The Institute is proud to have been associated with the beginning of the Corporation and to be so closely associated with it to-day. The cooperative agreement between these two organizations is an achievement in the progress of the profession, which makes possible a future full of promise of further accomplishment. To the officers and members, The Engineering Institute of Canada extends its congratulations, and its best wishes for the future. May the splendid record of the past be but a prelude to the future.

Herewith is the message sent to the Corporation by President Fetherstonhaugh to mark this occasion. It appears in the special anniversary publication of the Corporation.

Congratulations from The President of the Engineering Institute of Canada

It is a pleasure to me to have this opportunity of conveying to The Corporation of Professional Engineers of Quebec, on the attainment of its 25th anniversary, the congratulations of The Engineering Institute of Canada, and the Institute's sincerest good wishes for the future progress and welfare of the Corporation.

In conveying this message, my memory goes back to the days immediately following the first Great War, when two important changes took place in engineering organizations in Canada. The Canadian Society of Civil Engineers, which had always embraced in its membership men in all fields of engineering, came to the decision that its name should be changed to indicate the broad scope of its membership. Thus, the name became The Engineering Institute of Canada, and all the traditions and functions of the Canadian Society of Civil Engineers, which had been built up since its inception in 1887, were continued without interruption. The Engineering Institute was, and still is, a voluntary association having for its main objects the advancement and interchange of technical knowledge in the profession, and in general the promotion of the welfare of its members in their professional pursuits, and their relationship with the public.

At about the same time, the idea developed in the minds of engineers that some form of registration and licensing of properly qualified members be desirable as a protection to the public and the profession, and to give a more definite status to the professional engineer.

This development was fostered and encouraged by The Engineering Institute of Canada, and the result was the establishment of the provincial associations of professional engineers, each of which had its legal status as a licensing body recognized by its provincial act of incorporation.

The desirability of close co-operation between the branches of The Engineering Institute of Canada and the provincial associations is obvious to those who have the welfare of the profession as a whole at heart. The fields of the two types of organization should not overlap, but during the growth of the professional organizations, it has been inevitable that to some extent they actually have done so. By friendly co-operation, and a firm determination to iron out the differences that occur from time to time, the Associations and the Institute have managed to keep their mutual interests adjusted with a fair degree of success. It is hoped that this spirit of mutual goodwill will continue to mark their relationships.

The agreement recently concluded between the Corporation of Professional Engineers of Quebec and The Engineering Institute of Canada is an encouraging indication of the growth of the cooperative spirit and is already giving evidence of closer relations between members of the profession in Quebec, as similar agreements have done in other provinces.

In the mind of the young engineer, there frequently arises the question whether he should join the E.I.C. or the Association or both. The answer to this question depends on the attitude of the man to his profession, and to his own future advancements.

An engineer, with a sincere ambition to become a well qualified and leading member of his profession should obviously associate himself, as early as possible, with those bodies who are working towards the advancement of the welfare of the profession and its members, both in the direction of technical knowledge and in the enhancement of professional prestige. The ideal condition for the greatest welfare of the engineer as an individual and for the profession as a whole would therefore seem to be that every qualified practising engineer should join both The Engineering Institute of Canada and the professional association of his province.

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.

So, in congratulating the Corporation of Professional Engineers of Quebec on their notable achievement in the past twenty-five years, I express the hope that throughout the next quarter century they and The Engineering Institute of Canada may continue to work together, each in its own field, for the good of the profession of which we are all proud to be members.

E. P. FETHERSTONHAUGH,
President, E.I.C.

OIL

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What is oil?
Oil is the geologist working late at night
To correlate his fossils and map a structure.
It is the roar of a glycerine blast
Coming up from the bowels of the earth,
The soft hum of a giant turbine,
The rough talk of a gang pusher,
The screech of the rig as the drill bites in
And the reel goes out to six thousand feet.
It is the tears and hopes of little men,
The exploitation check, a fortune in hand,
The wildcat that didn't come through,
The gusher running uncapped
Or blazing like a torch of death.
It is the pipe line stretching across a continent,
The flash of light on the hooded monsters
Crouching low to join its seams,
The madcap scramble for concessions
In forgotten corners of the world,
The rough construction crews who come
To build from scratch a giant refinery,
The Texas foreman with the "know how"
Of years spent in the fields,
The pipefitters and layout men,
The giant cranes and tearing, smashing bulldozers,
The engineers and steel men,
The happy high riggers,
Who lift the giant fractionating columns,
Leading their dangerous craft
On a beam two-hundred feet in the air,
Or climbing to adjust the sheaves
For a big lift on a spider-thin gin pole,
Working with ease up in the blue.
It is the crane men swinging the loads,
Or the lad who drives the "cat".
You can spot them anywhere,
A tight knot around the bar at Shepheards
Talking of Java, Bogota, Texas,
The same lingo of the fields,
The sure mark, the leather jacket
And the battered grey fedora,
The Texas men in their cowboy boots
And tight-fitting pants
Being friendly to the northern boys,
Tanned dark and free-spending.
It is the two rupee coolie sweating on a jack hammer,
The sahib running out a line,
The roar of a giant concrete mixer
Pouring concrete in the rising forms,
The noise of a dozen electric generators
Supplying "juice" for the welders,
The pipefitters, boiler makers and bricklayers,
The gay party when a plant goes "on stream",
The milling throng on a native bazaar,
The noise of Saturday night in a small Oklahoma town.
It is the routine work of the checkers,
The operators who take over,
The men who run the giants
Keeping them "lined out"
Making the cuts on the crude,
Cracking the heavy ends,
Building the light gases,
To 100-octane products in the new units.
It is the big rubber plants,
The avenues of towers and steel
To help a nation win
When its rubber supply vanished,
And a nation had its back to the wall.
It's the boys on the graveyard shift
All over the world,
The big executive in the city skyscraper
Who comes to work at nine,
The guys who grease the valves,
The men who plan the work
And keep the big ones going,
The maintenance men and yard boys,
The routine testers in the lab.
Working day in and out
Doing the same thing over,
Doing the small jobs that make
The big things fit a pattern,
The process men and production force
Who push the plants to new limits,
The Standard man with the twenty-five-year button,
Knowing oil from the ground out,
The new men just starting
Fascinated by the spell of oil.
It's the long string of tank cars
Rattling across the continent,
A lonely wharf on a desert island,
A big loading terminal in Chicago,
A tanker wallowing in the North Atlantic
Or braving a run to Malta or Murmansk
Under a screen of fighters and flak,
The ready hands at a company picnic,
The good things of J. D. Rockefeller,
The pay check on Saturday night,
The race to win and hold,
To feed a monstrous war machine,
The girls at work at a thousand desks,
And men in faraway places who get it out,
Capetown, Lourenco Marques, Bahrein,
Bombay, Karachi, Port Elizabeth,
East London and Mombasa,
Strange names to Western ears,
And not so strange,
Richmond, Port Arthur, Jersey,
Houston, El Segundo, Bayway
Sweeney, Lockport and Baton Rouge.
This is the blood of a nation.
This is oil,
The great and small.
It is the old and new world,
Servant and master,
The tool of war and destruction
Lubricating our armoured divisions,
Storming the Siegfried line,
A Fortress blasting Berlin,
Powering a tractor plow
Turning the rich soil of Kansas,
Warming a home on a cold winter night,
The silver speck in the heaven
Speeding the mail from New York to 'Frisco,
The friendly product of peace,
The roadside station and free air,
The vaguely familiar "Fill 'er up"

When Sunday drivers crowd the roads
Seeking sunshine in the country.
But that is for tomorrow.
Today it's the men working overtime
Day in, day out, for victory,
The Service flags on the company mast-head
For boys who left to fight with guns,
The business statement on Wall Street,
The research men on a pilot plant,
The engineers who translate ideas to working drawings.
It is the big boys,—
Standard, Shell, Socony Vacuum, Imperial,
Texas, U.O.P. and Anglo-Iranian,
The rush and glitter of New York and Chicago,
The smell and filth of a native village.
It is the blood and sinews of war,
The food of machines in battle.
It is oil. It is victory.
It can be peace.

John Simmons Watt, s.e.i.c.

Bahrein Island, Persian Gulf — 1945.

MEETING OF COUNCIL

A regional meeting of the Council of the Institute was held at the Prince Edward Hotel, Windsor, Ontario, on Saturday, October 6th, 1945, at nine o'clock a.m.

Present: Vice-President J. E. Armstrong (Montreal), in the chair; Councillors H. E. Brandon (Toronto), G. G. Henderson (Windsor), Alex. Love (Hamilton), P. E. Poitras (Montreal), J. A. Vance (Woodstock), and General Secretary, L. Austin Wright.

There were also present by invitation—Past Vice-President J. Clark Keith; Past Councillors C. G. R. Armstrong, T. H. Jenkins, E. M. Krebser and G. E. Medlar, of Windsor; H. Massue, of Montreal, and J. G. Hall, of Toronto, also chairman of the Institute's Membership Committee; H. G. Stead, chairman of the London Branch; J. B. Stirling, chairman of the Montreal Branch, and chairman of the Institute's Committee on Professional Interests; A. H. MacQuarrie, chairman, J. B. Dowler, immediate past-chairman, F. J. Ryder, secretary-treasurer, and J. F. G. Blowey and J. G. Hoba, members of the executive of the Border Cities Branch.

Vice-President Armstrong extended a cordial welcome to all councillors and guests and asked everyone to feel free to take part in all discussions.

Death of E. C. B. Fetherstonhaugh: Mr. Armstrong informed Council of the death, in Montreal on October 4th, of the president's father, Mr. E. C. B. Fetherstonhaugh, in his ninety-fourth year. On the motion of Mr. Poitras, seconded by Mr. Vance, it was unanimously resolved that the following resolution be recorded in the minutes and a copy sent to the president:

> The Council of The Engineering Institute of Canada, meeting at Windsor, Ontario, on this date, learned with regret of the death of E. C. B. Fetherstonbaugh, the father of the president of the Institute. It joins with the president in an appreciation of the full life that his father has enjoyed, both in his family and in business, but at the same time wishes to express to him its most sincere sympathy in his bereavement.

International Federation of Engineering Societies: The general secretary reviewed briefly the action taken in regard to the proposed International Federation of Engineering Societies. When first approached, more than a year ago, the Institute had cabled one of its members in London asking him to attend the organization meeting as an observer only. Communications received from British institutions had indicated that they were not interested in the formation of such a federation. They were more interested in cementing relationships with existing bodies than in setting up a new organization. Last week the general secretary had had an opportunity to discuss the matter with officers of the American Society of Mechanical Engineers who have gone into the matter very thoroughly and are not in favour of it. For the benefit of those persons who had not attended previous council meetings, the general secretary commented briefly on the objectives of the proposed new organization. This was noted as a progress report for the information of Council.

Committee on Professional Interests: As there were many persons present at this meeting who were not at the previous meeting, Mr. Stirling, the chairman of the Committee on Professional Interests, commented in some detail on the information reported previously. He referred to his recent meetings with the officers of the Associations of Professional Engineers of Nova Scotia and New Brunswick, both of which indicated a healthy relationship between the Institute and the associations.

At the last meeting Mr. Stirling had been instructed by Council to approach the officers of the Corporation of Professional Engineers of Quebec with reference to the proposal to publish advertisements dealing with the registration of engineers. Council had thought that the material which had been prepared for the advertisements was somewhat unprofessional and the purpose of having Mr. Stirling discuss these with the Corporation was to see if some improved basis could not be found. Mr. Stirling reported that he had discussed this with the president of the Corporation and it was made quite clear to him that they would not consider withholding the advertisements or changing the copy. Mr. Stirling reported that there was, therefore, nothing further that the Institute could do in the matter.

International Meeting Detroit: The general secretary reported briefly on the International Meeting between the Detroit Section of the American Society of Mechanical Engineers and the Border Cities Branch of the Institute held on the fifth instant in Detroit. It was agreed that Council's appreciation of the Detroit Section's hospitality should be recorded in the form of a minute, copy to be sent to the chairman and secretary of the Detroit Section. Accordingly, on the motion of Mr. Henderson, seconded by Mr. Vance, the following minute was unanimously approved:

> The Council of The Engineering Institute of Canada, meeting in Windsor on this date, wishes

to express to the officers and members of the Detroit Section of the American Society of Mechanical Engineers its warm appreciation of the kindness and hospitality extended to the Canadian visitors upon the occasion of the International Meeting in Detroit on October 5th.

The occasion had a significance beyond the actual accomplishments of the meeting, for it marked for American and Canadian engineers everywhere the resumption of joint professional conferences such as are possible only in times of peace.

The Institute looks forward with pleasurable anticipation to many similar meetings in the future, and hopes that it may meet its Detroit friends frequently, under such happy and profitable circumstances.

Proposal to Increase Fees: Mr. Armstrong commented on the various items in the memorandum from the Finance Committee regarding a proposed increase in the annual fee which had been sent to all branch executive committees and to all councillors. Replies were being received from the various branches and the Finance Committee hoped that it would be able to prepare its final recommendations in time for the matter to be dealt with at the 1946 annual meeting. This progress report was noted.

Annual Meeting 1946: The general secretary announced that the annual meeting would be held in Montreal on February 7th and 8th 1946. It was hoped that by that time conditions regarding transportation and hotel accommodation would be greatly improved.

Planning for Ottawa Federal District: The general secretary reviewed Council's action at the previous meeting at which it was agreed that the Institute should interest itself in the situation which had developed due to the selection of a non-Canadian (Mr. Greber, of Paris, France) as the designer and planner for the Ottawa Federal District. A small committee had been appointed and since the previous meeting had met and sent a telegram to the Prime Minister stating the Institute's position. The telegram is as follows:

"Montreal, Sept. 17th, 1945.

"The Council of The Engineering Institute of Canada is concerned to learn through the press that the planning for the Ottawa Federal District and War Memorial is to be given to a non-Canadian stop Council believes that the national significance of the Memorial and the necessity of a comprehensive knowledge of local physical and social conditions demands that citizens of this country be responsible wholly for its planning and design and that Canadian engineers, architects and other interested groups are fully competent to do the work stop Would you kindly inform Institute if press report is correct and if so is Mr. Greber to act only as consultant or to be in full charge of planning stop Would representations from the Institute in this matter be welcomed now."

The Prime Minister's reply is as follow:

" Ottawa, Sept. 18th, 1945.

" Dear Mr. Wright:

I duly received your telegram of the 17th of September, sent on behalf of the Council of The Engineering Institute of Canada, concerning the invitation extended to Mr. Jacques Greber, in connection with the Government's proposal for the beautification of Ottawa as a national war memorial.

With respect to this invitation, I should perhaps point out that Mr. Greber has been invited to complete a plan which he had already begun before the outbreak of war. The members of the Institute will, I am sure, agree, upon reflection, that it is desirable to have the plan completed along general lines already laid down and partially executed. I can assure you that the Government had no thought of reflecting upon or overlooking the work of Canadian landscape architects and engineers, and that it is our hope that, as plans for national development and community planning unfold in the years of reconstruction, abundant scope will be found for the talent of Canadian engineers and artists.

Yours sincerely,

(Signed) W. L. Mackenzie King."

The general secretary reported that he had been present at a meeting in Ottawa with Councillor W. L. Saunders and Mr. S. H. Maw, representing the Royal Architectural Institute of Canada, at which a proposal already approved by the Ottawa committee of the Architects' Association had been discussed. This proposal offered an alternative to handing the work over entirely to one outside person. The discussion had disclosed some possible improvements in the proposal, and it was understood that Mr. Maw would resubmit this to the architects' committee and would then communicate with Mr. Wright. To date no further word had been received from Mr. Maw.

Mr. Jenkins inquired as to the possibility of controlling Mr. Greber's activities in Ontario and Quebec by means of withholding a license to practise either as an architect or an engineer. It was pointed out, however, that this might be met by making Mr. Greber an employee of the Federal government in which case the provincial registration act would not apply. The general secretary now asked for instructions as to future action of the committee.

In the general discussion which followed it was unanimously agreed that the arbitrary selection of Mr. Greber was not a compliment to Canadian engineers or architects and that the Institute was justified in working with others in an endeavour to improve this situation.

Mr. Stirling referred to the War Memorial now erected in Ottawa. For this project a competition had been established, open to every person in the world. About six hundred submissions had been made. He thought the Institute should go cautiously until it was clearly indicated which was the best policy to follow. He pointed out that as the present monument had been built and designed outside of Canada it might not be reasonable to argue that the extension of the planning for Ottawa and district should be done solely by Canadians.

In response to an inquiry as to the position of the R.A.I.C., the general secretary reported that the only contact that had been established was with Mr. Maw, of Ottawa.

Eventually it was agreed unanimously to take no further action publicly until the situation had been investigated further, as a part of which the Federal District Planning Commission should be consulted. Consideration should be given to making a joint submission with the R.A.I.C. and other organizations that were similarly interested. It was also agreed that if the necessity to take action should occur before the next meeting of Council, the committee, in consultation with Vice-President Armstrong, would be authorized to act.

Government Housing Scheme — At the last meeting of Council the shortage of housing accommodation and the inadequacies of the government housing scheme was drawn to the attention of Council and it was decided that the matter should be brought up at a later meeting of Council with more specific information. Mr. Armstrong now presented a thirteen page memorandum on the subject, prepared by a non-member of the Institute, which was summarized as follows:

The problem is a large scale shortage of housing accommodation.

Precise measurement of this shortage is impossible. There are three subdivisions of the problem:—

1. The general overall shortage which the Government has unsuccessfully endeavoured to alleviate by the provision of cheap money.
2. Emergency shelter for the coming winter.
3. Better grade low rental housing.

Suggestion:

" This is a problem which involves ethics, economics and aesthetics. It is a problem of such proportions and involving such difficulties that it is probably not an exaggeration to say that on its correct solution depends the nature of our society in the future.

" My own knowledge of the subject is too inadequate for me to offer anything which savours of being a plan of action. I do suggest that there is a case here in which this Institute may find a great opportunity to render valuable services to the nation.

" My suggestion is that this Institute should set up a committee to study the housing problem in all its aspects, and that the Institute should invite distinguished students in other fields than those of engineering and construction to serve as members of this committee, or at least to place their views before the committee."

In Mr. Armstrong's opinion the ideas expressed in the memorandum were basically sound, but before taking any action or making any recommendations he felt that a small committee should be appointed to study the whole problem and recommend a policy to Council.

Considerable discussion followed, and it was agreed that the Engineering Institute, as representing the engineers in Canada, should take an active interest in this Dominion-wide housing shortage problem. Just what the Institute could do to help could not be decided without a complete study of the problem, and on the motion of Mr. Love, seconded by Mr. Poitras, it was unanimously resolved that a small committee be appointed to make a preliminary investigation and report back to Council with recommendations as to what the Institute should do. The selection of the committee was left to Vice-President Armstrong.

Report of Board of Examiners: The general secretary presented the following report from the Board of Examiners:

" Some time ago you asked your Board of Examiners to study the Institute's examination system and to make such recommendations for its reform as your Board might think fit. Your Board submits its report on this matter in the following paragraphs.

It is your Board's unanimous opinion that the Institute examinations should be abolished. The number of candidates writing these examinations is small, the number passing, of course, smaller still. The cost of the examinations is out of proportion to the benefits received. Council could deal with all applications from those not educationally qualified under powers which it now possesses and frequently exercises.

In place of the Institute's own examinations, your Board recommends that the examinations of the various provincial professional associations be accepted. Arrangements to this end could undoubtedly be made with those associations with which the Institute has co-operative agreements, and your Board anticipates that it would not be difficult to make similar satisfactory arrangements with the professional associations of the other provinces. This would provide a means of entry to the Institute for all candidates save the very occasional one from Prince Edward Island. Applications from this province could be dealt with by Council directly.

The arrangement suggested would certainly result in no lowering of the standards of admission to the Institute and might even raise them. Further, it would be a gesture of confidence in the provincial professional associations which might result in cementing still further the cordial relations between these associations and the Institute.

Your Board recommends, therefore, that this scheme be laid before the provincial professional associations, and that arrangements be made with them to put it into effect without delay.

Respectfully submitted,

E. Brown
J. Hurtubise
R. de L. French, Chairman
Board of Examiners,
Engineering Institute of Canada ".

The general secretary pointed out that if this report is accepted the result would be that when an application is received from some one who has not the required educational qualifications, Council's decision would be that he should apply for admission to the provincial professional association. If he writes their examinations and is successful, such standing would be accepted as meeting the Institute's educational requirements. Mr. Wright outlined briefly the present procedure. Few candidates sit for the examinations and of those who do only about half pass.

Following some discussion, on the motion of Mr. Poitras, seconded by Mr. Love, it was unanimously resolved that the report of the Board of Examiners be accepted and approved.

Canadian Chamber of Commerce: On the motion of Mr. Brandon, seconded by Mr. Love, it was unanimously resolved that Dr. Arthur Surveyer be reappointed as the Institute's representative on the Canadian Chamber of Commerce for 1946.

List of Members: Mr. Massue inquired as to the possibility of getting out a new membership list, and Mr. Wright explained that paper shortage and staff shortage had prevented the preparation of such a list. It was hoped, however, that in 1946 it would be possible to publish one.

As a past councillor, Mr. Jenkins expressed his pleasure at being able to attend this regional meeting. On behalf of all non-members of Council, he extended their thanks and appreciation of being invited to attend this meeting.

Mr. Armstrong expressed the thanks and appreciation of Council to the members of the Border Cities Branch for the very fine arrangements which had been made for the International Meeting, for the Council meeting, and for the transportation to the Sarnia meeting. It had been a particular pleasure to have so many past officers present.

It was decided that the date for the next meeting of Council should be left open subject to the call of the president, possibly on the 10th or 17th of November.

There being no further business, the Council rose at twelve forty-five p.m.

ELECTIONS AND TRANSFERS

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

Members

Angerman, Jaroslaw Kazimierz, M.S. (Elect. Engr.), (Politechnika, Lwow, Poland), designer, Montreal Armature Works, Montreal, Que.
Garner, Albert George, R.P.E., Ontario, sales engr., Hamilton Bridge Co., Stratford, Ont.
Grabill, Dayton Leslie, B.A.Sc., (Honors), (Univ. of Toronto), asst. vice-pres., Johnson & Johnson, Ltd., Montreal, Que.
Gregg, Elwyn Emmerson, B.A.Sc., (Univ. of British Columbia), forest engr., Vancouver, B.C.
Jolly, John Wilson, Int. B.Sc., (Mech.), (Univ. of London), inspector fuzes, Inspection Board of U.K. & Canada, Ottawa, Ont.
MacDonald, Frank Sanborn, B.Sc. (Mech.), (N.S. Tech. Coll.), Sherbrooke Machineries Ltd., Sherbrooke, Que.
Ward, Robert Grenville Distin, (F/L., R.C.A.F.), B.Sc., (Elect), (Univ. of Alberta), now overseas.
Wisnicki, Boleslaw Pul, Mech. & Aero Engr., (Politechnika Lwowska, Poland), Chief Designer, Canadian Wooden Aircraft Ltd., Toronto, Ont. (Now in Vancouver, B.C., c/o Hotel Georgia).

Junior

Garcia, Alvin Francis, B.A.Sc. (Mining), (Univ. of Toronto), supt., Arvida Works, Aluminum Co. of Can., Ltd., Arvida, Que.

Transferred from the class of Junior to that of Member

Boulton, Charles Albert, B.Sc., (Civil), (Queen's Univ.), E.G.M. Cape & Co., Ltd., Halifax, N.S.

Transferred from the class of Student to that of Member

Birt, Thomas William, W/C., R.C.A.F., B.Sc., (Elect.), (Univ. of Manitoba), Chief Engrg. Officer, No. 9 B. & G., Winnipeg, Man.
Eldridge, John Bryson, Major, R.C.E., B.Sc., (Elect.), (Univ. of New Brunswick), now overseas.
Lauchland, Lyman Stuart, Lt. Col., B.A.Sc., M.A.Sc., (Elect.), (Univ. of Toronto), Toronto, Ont.
McKernan, Earl Wesly, B.Sc., (Elect.), (Univ. of Alberta), supt., Saguenay Power Company, Isle Maligne, Que.
Smallwood, Robert Edwards, B.A.Sc., (Mech.), (Univ. of Toronto), engr., i/c transmission and rubber mill machinery, Dominion Engineering Works, Ltd., Montreal, Que.

Transferred from the class of Student to that of Junior

Anderson, Clarence Arthur, Capt., C.R.T.C., B.Sc., (Elect.), (Univ. of Manitoba), Winnipeg, Man.
Campbell, John Graham, B.Sc., (Queen's Univ.), potroom supvr., Arvida Works, Aluminum Co. of Can., Ltd., Arvida, Que.
Haacke, Ewart M., B.Sc., (Elect.), (Queen's Univ.), editor Electrical News & Engineering, Toronto 2, Ont.
Hetherington, Wordsworth, B.A.Sc., (Elect.), (Univ. of British Columbia), Steel Co. of Canada, Ltd., Montreal, Que.
Holland, Henry Alfred Nelson, B.Eng., (Civil), (McGill Univ.), plant engr., Bell Telephone Co., Canada, Montreal, Que.
Quist, Jack Ernest, Elect. Lt. R.C.N.V.R., B.A.Sc., (Elect), (Univ. of Toronto), with N.S.H.Q., Ottawa, Ont.

Student Admitted

Colter, William Royden, (Univ. of New Brunswick), 55 Alexandra St., Fredericton, N.B.
Follett, Douglas John, (McGill Univ.), 490 Pine Ave., West, Montreal 18, Que.
Forgues, Robert, (McGill Univ.), 2168 Sherbrooke St. West, Apt. 12, Montreal, Que.
Grant, Peter Stuart, (McGill Univ.), 3581 University St., Montreal, Que.
Keirstead, Hazen Miles, (Univ. of New Brunswick), 382 Regent St., Fredericton, N.B.
Lafrance, Paul-Emile, (St. Francis Xavier Univ.), Antigonish, N.S.
Marmur, Ben, B.Eng., (McGill Univ.), 4283 St. Urbain St., Montreal, Que.
Pryde, James Morrison, (McGill Univ.), 3581 University Street, Montreal, Que.
Purdy, Harold Christie, Sub. Lt. (E). R.C.N.V.R., B.Sc. & B.Eng., (N.S. Tech. Coll.), Bedford, N.S.
Ryan, Donald Laurent, 2/Lt., R.C.E., B. Eng., (N.S. Tech. Coll.), 74 Oxford St., Sydney, N.S.
Skelton, Philip Edwin, (McGill Univ.), 763 Upper Lansdowne Ave., Montreal 6, 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

McClary, Norman Harold Gordon, asst. dist. airways engr., Department of Transport, Edmonton, Alta.
Palmason, John Harold, B.Sc., (Civil), (Univ. of Manitoba), asst. supt., western region, Dominion Tar & Chemical Co., Ltd., Calgary, Alta.

Student to Member

Paget, Kenneth K., B.Sc., (Civil), (Univ. of Manitoba), Diamond Engineering Co., Ltd., Calgary, Alta.

QUEBEC

Members

Brisbane, John Sutherland, B.Sc., (McGill Univ.), Dist. Construction Supervisor, Veterans Land Act, Montreal, Que.
Olive, Charles Edward, Cmdr. (S.B.E.), R.C.N.V.R., B.Sc., (Honors), (King's College, Univ. of London,) Ottawa, Ont.

PROFESSIONAL MEETING IN MARITIMES

Recently it has been decided to resume the regular feature of professional meetings in different parts of Canada. The first tangible evidence of progress in this direction comes from Halifax.

It has been agreed that the Engineering Institute and the Provincial Professional Association shall hold a joint professional meeting at the Pines Hotel, Digby, Nova Scotia, during September, 1946.

The Halifax Branch has appointed L. E. Mitchell as its committee head, and the Association of Professional Engineers of Nova Scotia has appointed G. J. Currie to the same post. These gentlemen have power to add to their numbers, as it is planned that in due course they shall call together a committee adequate to the purpose.

The last professional meeting, apart from the annual meeting, was also in the Maritime provinces. At the conclusion of the first day's programme, the announcement of outbreak of war was made, and the meeting was adjourned immediately. Therefore, it seems appropriate that the first professional session, after cessation of hostilities, should be in the Maritime Provinces. It can be looked upon as the continuation of the adjourned meeting.

From time to time, as information becomes available, the *Journal* will keep this membership informed.

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*.

Air Vice-Marshal E. W. Stedman, M.E.I.C., who has been serving as director-general of air research in the Royal Canadian Air Force at Ottawa, has recently retired from the R.C.A.F. Air Vice-Marshal Stedman, who is a Whitworth Scholar and an Associate of the Royal College of Science, London, served from 1914 until 1919 in the Royal Naval Air Service and the Royal Air Force. He came to Canada in 1920 as director of the technical section at the Air Board, Ottawa, and later became chief aeronautical engineer, R.C.A.F. He was appointed to the post of director-general in 1942 and has devoted his time to the study of research and development work in close collaboration with the National Research Council.

John H. Dyer, M.E.I.C., is at present associated with the Sutcliffe Company Limited at New Liskeard, Ont. He was formerly electrical switchgear draughtsman with The English Electric Company of Canada, St. Catharines, Ont.

Colonel Frank S. Milligan, M.E.I.C., who for the past five years has been serving with the Royal Canadian Engineers, has returned to his private practice in Toronto, Ont, with the firm of F. S. Milligan and Company, engineers and constructors.

S. H. de Jong, M.E.I.C., has been appointed to the staff of the University of British Columbia at Vancouver, B.C. Since 1940 he has been a demonstrator in the department of civil engineering at the University of Toronto. During this past summer he was employed by the Hydrographic and Map Service, Ottawa, and was working in the Noranda district in northwestern Quebec.

L. A. Petrie, M.E.I.C., has severed his connection with the Aluminum Company of Canada Limited at Toronto, and has taken a position as senior engineer with the St. Clair Processing Corporation, Sarnia, Ont.

C. A. Hellstrom, M.E.I.C., is now employed as efficiency engineer for the Woods Department of Canadian International Paper Company in the mill at Temiskaming, Que. He was previously with Brompton Pulp and Paper Company, Limited, at Red Rock, Ont.

J. E. Clark, M.E.I.C., of the Bell Telephone Company of Canada, has been transferred from the plant engineering department at Ottawa, Ont., to the outside plant and transmission division, chief engineer's office, Eastern Area, at Montreal, Que

Gustave St. Jacques, M.E.I.C., has been appointed engineer-economist with the Provincial Transportation and Communications Board at Montreal, Que. He was previously executive assistant to the Associate Transit Controller in the Department of Munitions and Supply, at Montreal.

News of the Personal Activities of members of the Institute

A. Sandilands, M.E.I.C., of Automatic Electric (Canada) Limited, has been transferred from Edmonton, Alta., to Winnipeg, Man.

Major J. W. Young, has been released from the Royal Canadian Engineers and has accepted the position of gas engineer with the Madison Natural Gas Company in Turner Valley, Alta.

Professor W. J. T. Wright, M.E.I.C., has been appointed director of studies of the new Ajax Division of the University of Toronto. Professor Wright received his early education in Toronto while his father was professor of architecture at the University. He graduated from the University of Toronto with honours in applied science and later received his B.A. degree. Professor Wright has been on the staff of the University of Toronto since 1912 with the exception of his period of war service from 1916 until 1919. He served in World War I, first in command of a battery and later with railway troops. For distinguished service he was awarded the M.B.E.

Allan C. Ross, M.E.I.C., president of Ross and Meagher Limited, contractors, in Ottawa, Ont., was named adviser to Harry Taylor, employers' delegate to the International Labour Conference held in Paris in October.

Louis O'Sullivan, M.E.I.C., has been appointed assistant general manager of the Quebec Hydro-Electric Commission. Mr. O'Sullivan joined the staff of the old Montreal Light, Heat and Power Company in 1923 and has since then held successively the positions of field engineer, design engineer, and transmission and right-of-way engineer. His duties were connected with the design and construction of electrical substations, transmission and distribution lines, as well as supervision of land surveys, property purchases and title records. In 1942 he was appointed general executive assistant.

Pilot Officer E. S. Braddell, M.E.I.C., has retired from the R.C.A.F., and has returned to the Northern Electric Company Limited, at Montreal. Previous to his enlistment he was with this firm at Winnipeg, Man.

R. W. Emery, M.E.I.C., assistant chief engineer with Marathon Paper Mills of Canada Limited at Toronto, has been transferred to Marathon, Ont., where he will act as resident engineer on the construction of a sulphate mill.

Dr. Paul Gagnon, M.E.I.C., director, department of chemical engineering, Laval University, Quebec, is among the new members appointed to the National Research Council. **Dr. Arthur Surveyer,** M.E.I.C., consulting engineer, Montreal, and past-president of the Institute, has been reappointed a member. Dr. Surveyer received his first appointment to the Council in 1942.

R. A. Yapp, M.E.I.C.

H. M. Black, M.E.I.C.

R. A. Yapp, M.E.I.C., sales manager of Bepco Canada Limited, has completed 25 years' service with the firm. A graduate in engineering of the University of London, England, he began his apprenticeship course in 1920 at the Trafford Park Works of the Lancashire Dynamo and Crypto Company, Limited, and four years later came to Canada as estimating engineer at the head office of the Lancashire Dynamo and Crypto Company of Canada Limited at Toronto. In 1926 he moved with the head office to Montreal. When this company amalgamated with Bruce Peebles (Canada) Ltd., Crompton Parkinson Canada Limited and Harland Engineering Company of Canada Limited, to form Bepco Canada Limited, Mr. Yapp was appointed sales manager of the new firm.

For many years Mr. Yapp has been active in the affairs of the Montreal Branch of the Institute.

W. R. Craig, M.E.I.C., has recently been released from the Canadian Army and has returned to B.C. Sugar Refining Co. Limited at Vancouver, B.C., where he is employed as assistant to the chief engineer.

James B. Nelson, ME.I.C., has resigned his position as chief draughtsman with Welland Chemical Works Limited and is now associated with E. Leonard & Sons Limited, London, Ont., in an engineering capacity.

Douglas Simpkin, M.E.I.C., has been released from the Royal Canadian Engineers and has returned to Noranda, Que., where he is employed by Noranda Mines Limited.

R. O. McGee, M.E.I.C., has left the service of the Inspection Board of the United Kingdom and Canada, on which he held the position of inspection officer (Materials). He has recently established his private practice as a patent attorney in Ottawa, Ont.

Colonel D. C. Stephenson, M.E.I.C., has been released from the Canadian Army and has returned to his civilian employment as superintendent and engineer for the B.C. Power Commission, Vancouver Island Branch, formerly Nanaimo-Duncan Utilities Ltd., Nanaimo, B.C.

H. M. Black, M.E.I.C., has been appointed manager of the Ontario Division of Dominion Engineering Company Limited. Mr. Black graduated from McGill University in 1923 with the degree of B.Sc. in mechanical engineering and subsequently joined the staff of the Allis-Chalmers Company, Milwaukee. In 1927 he became associated with the English Electric Company of Canada Limited. He was with this company for 13 years, formerly in charge of the firm's Toronto office and latterly as general superintendent. In 1940 he joined the Dominion Engineering Company Limited as manager of the company's Longueuil Ordnance Plant at Longueuil, Que. Under his direction this plant achieved a distinguished war production record. He remained in this position until his recent appointment. With his background of sales and production experience in industrial engineering, Mr. Black will direct the sales, service and research activities in Ontario for the company's six engineering divisions: Paper, Hydraulic, Industrial Machinery, Diesel, Manufacturing and Dominion Hoist and Shovel.

R. H. Ransom, M.E.I.C., has accepted the appointment of science specialist at Baron Byng High School, Montreal, Que. A graduate of McGill University in 1935 with the degree of B.Eng., he has been serving in the R.C.A.F. until his recent release.

C. K. Hurst, M.E.I.C., has been released from the Royal Canadian Navy and has now resumed his position as assistant engineer with the Canals Branch, Department of Transport, Ottawa, Ont.

C. O. Whitman, M.E.I.C., has accepted the position of senior estimating engineer, Public Projects Division, Department of Reconstruction, Ottawa, Ont. He was formerly employed with Defence Communications Limited, a Crown company.

Harold G. Mosley, M.E.I.C., has recently returned from overseas and is now employed in the engineering department of the Dominion Coal Co. Limited at Glace Bay, N.S.

Ralph E. Williams, M.E.I.C., has joined the staff of the Ontario Paper Company at Baie Comeau, Que., as a field engineer. Mr. Williams had been in British Guiana since 1942 where he was employed by Demarara Bauxite Company.

Francois Valiquette, M.E.I.C., has resigned his position at the St. Vincent de Paul Penitentiary and is now employed as assistant district engineer at Montreal by the Bridge Division, Department of Public Works, Province of Quebec.

G. A. Vandervoort, M.E.I.C., has accepted the position of technical adviser with the British Columbia Power Commission, Victoria, B.C. He was previously associated with the New Brunswick Power Commission, St. John, N.B.

C. V. F. Weir, M.E.I.C., has been released from the Canadian Army with which he has been serving since September, 1939. He has returned to the city power plant of Edmonton, Alta, as electrical engineer.

C. J. Lynde, M.E.I.C., is now connected with the Maple Leaf Milling Co. Ltd. at Toronto, Ont., in the capacity of chief engineer.

F. C. Read, Jr.E.I.C., is at present associated with Poole's Adhesives at London, Ont. He was formerly employed by Dominion Tar and Chemical Company, Limited, Toronto, Ont.

Group Captain M. M. Hendrick, Jr.E.I.C., has returned from overseas to take over the Directorate of Signals at R.C.A.F. Headquarters at Ottawa.

A. J. Ring, Jr.E.I.C., is now associated with H. G. Acres & Company, consulting engineers, Niagara Falls, Ont. He was previously employed as supervisor in the cordite department of the Nobel, Ont., works of Defence Industries Limited.

Captain R. W. Morris, Jr.E.I.C., has retired from the Canadian Army (Active) and has accepted a position in the engineering department of Trans-Canada Air Lines at Winnipeg, Man.

G. W. Moule, Jr.E.I.C., is now employed as designing engineer with the Hydro-Electric System, City of Winnipeg, Man. He was formerly connected with Defence Industries Limited at Montreal as electrical engineer.

(Elect.) Sub-Lieutenant J. J. Dupuis, Jr.E.I.C., has recently been released from the Royal Canadian Navy and is now employed by the Consolidated Paper Corporation, Belgo Division, Shawinigan Falls, Que.

J. P. Estabrook, Jr.E.I.C., of the Aluminum Company of Canada Limited, has been transferred from Shawinigan Falls to the works at Arvida, Que.

D. Lorne Lindsay, Jr.E.I.C., has been released from the R.C.N.V.R. and is now associated with the firm of G. Lorne Wiggs and Company, consulting industrial engineers, Montreal. Mr. Lindsay graduated from McGill University with the degree of B.Eng. (Mech.) in 1941, and subsequently enlisted in the Navy.

F/O J. G. S. McMorine, Jr.E.I.C., has retired from the R.C.A.F., and has resumed work as junior hydraulic engineer with the Dominion Department of Agriculture (P.F.R.A.) at Regina, Sask.

Alex H. Holden, Jr.E.I.C., who has been serving with the Royal Canadian Navy, has returned to his former employers, Canadian Industries Limited. Prior to his enlistment Mr. Holden was ballistic engineer of the ammunition division, Brownsburg, Que. He has now been transferred to the nylon division at Kingston, Ont.

J. B. Mantle, Jr.E.I.C., on his release from the R.C.A.F., has accepted a position as instructor in engineering on the staff of the University of Saskatchewan at Saskatoon, Sask. Mr. Mantle graduated from the University with the degree of B.Sc. (Mech.) in the class of '41.

Group Captain A. Deane Nesbitt, D.F.C. and Bar, S.E.I.C., has returned to his home in Montreal. An active member of the Montreal Light Aeroplane Club, he joined the R.C.A.F. in 1939. When his plane was damaged during air combat in 1940 he became a member of the "Caterpillar Club", comprised of those forced to bail out. In 1941 he returned to Canada and led a squadron of Kittyhawks to Western Canada and ultimately to Alaska. He was then attached to Air Force Headquarters in Ottawa until January, 1944, when he took over command of No. 6 Service Flying Training School at Dunnville, Ont. In March of that year he returned overseas to join 83 Group of the 2nd Tactical Air Force and later commanded 143 Wing, Flying Typhoons in Holland and Germany. He was in command of the first R.C.A.F. airfield to land in France after D-Day. Group Captain Nesbitt was awarded the Distinguished Flying Cross for his leadership and devotion to duty.

Denis Noiseux, S.E.I.C., who graduated from Ecole Polytechnique, Montreal, last May with his B.A.Sc. in civil engineering, has gone to Cambridge, Mass., to take a post-graduate course at the Massachusetts Institute of Technology.

Major John Kenneth French, S.E.I.C., has recently been promoted to his present rank with his appointment as Deputy Assistant Director of Mechanical Engineers at Headquarters of the Canadian Forces in the Netherlands. A son of Professor R. De L. French, M.E.I.C., he is a graduate in mechanical engineering from McGill University in the class of 1940.

L. S. Lauchland, S.E.I.C., who has returned from overseas and retired from the active list of the Canadian Army, now holds the position of assistant professor in the department of electrical engineering at the University of Toronto, Ont.

Frank H. Edwards, S.E.I.C., has completed his instructional work in radar at H.M.C. Signal School and has been released from the R.C.N.V.R. He has resumed his studies in engineering at McGill University.

Obituaries

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

George Blanchard Dodge, M.E.I.C., died at his home in Ottawa, Ont., on October 4th, 1945, after a brief illness. Born at Halifax, N.S., on August 2nd, 1874, he attended Dalhousie University. He was licensed as a Dominion Land Surveyor.

The years from 1891 until 1894 he spent in British Guiana, in charge of the construction of a new sugar refinery. On his return to Nova Scotia he was employed in the power house of the Halifax Electric Tramway Company for two years. From 1898 to 1904 Mr. Dodge was employed with the British hydrographic survey working in Newfoundland, before transferring to the Canadian hydrographic survey. In 1904 he joined the Topographical Surveys Branch of the Department of the Interior and two years later worked on the hydrographic survey at Prince Rupert for the Marine and Fisheries Department. In 1907 and 1908 he made the latitude observations on the survey of the British Columbia—Yukon boundary.

Mr. Dodge joined the Institute as an Associate Member in 1907, transferring to Member in 1911. He was made a Life Member in 1934. Mr. Dodge served as chairman of the Ottawa Branch in 1920 and as a councillor of the Institute representing the Branch from 1921 until 1923.

Aimé Collet, M.E.I.C., died on August 31st, 1945, at his home in Westmount, Que. Born at Montreal, Que., on February 28th, 1898, he graduated in civil engineering from the Ecole Polytechnique, Montreal, in 1923.

His whole business career was spent with Collet Frères Limitée at Montreal, a civil engineering firm responsible for the erection of many large Montreal buildings. At the time of his death Mr. Collet was president of the firm.

Mr. Collet joined the Institute as an Associate Member in 1928, becoming a Member in 1940.

James Paul Norrie, M.E.I.C., died of a heart attack in Noranda Hospital, Noranda, Que., on October 9th, 1945. Born at Truro, N.S., on April 25th, 1891, he attended Mount Allison University and Nova Scotia Technical College, graduating from the latter institution with his degree of B.Sc. in mining in 1913.

Mr. Norrie began his professional career in Nova Scotia and, in 1913-14, served as deputy minister of mines for the province. He later became manager of the Moose Head Reduction Company at Moose Head, N.S., and in quick succession became manager of Great Falls Mine, Maryland, Potomac, Md., and concentrating and smelting superintendent of Rome Brass and Copper Company at Rome, N.Y.

In 1917 he became superintendent and metallurgist of Monarch Metal Co. Ltd., Hamilton, Ont., and two years later was employed in the same capacity by Electro Tin Products Limited, Brantford, Ont. In 1921 he accepted the position of superintendent of the Porcupine Davidson Gold Mines Limited, South Porcupine, Ont., and two years later became underground superintendent of Sylvanite Gold Mines Limited at Kirkland Lake, Ont.

In 1924 Mr. Norrie moved into the then almost untouched field of the northern Quebec mining country and among the positions he held there was that of manager of Stadacona Rouyn Mines Limited, Rouyn, Que., and later of Malartic Gold Mines Limited, Malartic, Que. In 1928 he was employed as field engineer by Dominion Explorers Limited, Toronto, Ont., and two years later accepted the position of manager with Bussieres Mine of Treadwell Yukon Co. Ltd., Pascalis, Que.

At the time of his death Mr. Norrie was general manager of Perron Gold Mines Limited, and general manager and vice-president of Inspiration Mining and Development Company, Limited, and of Dubuisson Goldfields Limited. He was connected with the early development of the East Malartic mine, from the directorship of which he resigned in 1943. Besides having a large practice as a consulting engineer, he was actively connected with the direction of many mining companies. He was a leader in post-war plans for the mining development of the province of Quebec.

Mr. Norrie joined the Institute as a Member in April 1945.

News of the Branches

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

BORDER CITIES BRANCH

F. J. Ryder, M.E.I.C. - *Secretary Treasurer*
J. G. Hoba, Jr.E.I.C. - *Branch News Editor*

"We have entered into the period of the application of science to war and the speedy rate makes the arms of to-day of lessened value for to-morrow," said General A. G. L. McNaughton, while addressing an International Meeting at the Horace H. Rackham Memorial Building in Detroit on October 5th, 1945.

General McNaughton was the guest speaker at a joint meeting sponsored by the Detroit Section of the American Society of Mechanical Engineers and the Border Cities Branch of The Engineering Institute of Canada. It was a full day of interesting events for General McNaughton and his party, and for the members and guests of the two organizations.

General McNaughton, was entertained at luncheon at the Detroit Club by James Parker, president of the Detroit Edison and past-president of the A.S.M.E., who also had as his guests, J. H. Walker, vice-president of the Detroit Edison, H. E. Barth, vice-president of the American Blower Corporation, A. L. Pasini, chairman, Detroit Section A.S.M.E., and A. H. MacQuarrie, chairman, Border Cities Branch, E.I.C.

At the same time, Mrs. McNaughton was being entertained at the Detroit Yacht Club by Mrs. Leathermore, Mrs. Soderberg, and Mrs. Boddy.

The American Blower Corporation, credited with being a leader in its branch of industry, was the object of a visit in the afternoon by about eighty members and guests. There, considerable interest was shown in the manufacture of fluid drives, exhaust fans, boiler room equipment, dust collectors, and air washers.

Of particular importance and interest to everyone, was the equipment in the Research Laboratories, where the guest saw experiments in dust analysis, sound testing, and fluid air mechanics.

In the evening, about one hundred and seventy-five guests and members sat down to dinner in the Banquet Hall in the Horace H. Rackham Memorial Building. J. F. Armstrong, vice-president of the E.I.C., was the toastmaster and introduced the head table guests who were:

General and Mrs. A. G. L. McNaughton, Mr. and Mrs. A. L. Pasini, Mr. and Mrs. H. E. Barth, Mr. and Mrs. R. K. Weldy, Mrs. G. G. Henderson, Mrs. F. J. Ryder, Mr. James Parker, Mr. A. H. MacQuarrie, Mr. J. W. Brennan, Mr. J. G. Hoba.

A presentation of the Canadian and American colours by the Canadian Branch of the Grosse Point Post of the American Legion opened the meeting portion of the day in the auditorium. General McNaughton accepted the salute from the representatives of the Post, several members of whom had served in the same unit in World War 1 as had General McNaughton.

A. L. Pasini made the introductory remarks on behalf of the A.S.M.E. and A. H. MacQuarrie spoke on behalf of the E.I.C.

"Soldier, scientist, and skilled administrator," said James Parker in introducing General McNaughton as the guest speaker of the evening. General McNaughton's subject, **Canadian Engineering in the War—A Tribute to the Part Played by Canadian Engineers** was highly received by the audience, as was indicated by the long and vigorous question period which followed the talk.

On the following morning, a Regional Council Meeting was held in Windsor, at which Mr. Armstrong presided, and in the afternoon, many of the Councillors and members of the Border Cities Branch of the E.I.C. travelled to Sarnia for the inaugural night of the new Branch, at which both G. G. Henderson, Branch Councillor, and A. H. MacQuarrie, branch chairman, spoke.

HAMILTON BRANCH

W. E. Brown, m.e.i.c. - - *Secretary-Treasurer*
L. C. Sentance, m.e.i.c. - *Branch News Editor*

On Tuesday, September 25th, the Hamilton Branch of the Institute and of the American Institute of Electrical Engineers met jointly in the auditorium of the Canadian Westinghouse Company to hear Mr. P. H. Take, welding engineer, Canadian General Electric Company, speak on **Atomic Hydrogen Welding.**

The meeting was opened by N. Eager, chairman of the Hamilton Branch of the E.I.C., who later relinquished the chair in favour of J. Somerville, chairman of the Hamilton Branch of the A.I.E.E. J. A. McKenzie introduced the speaker.

Mr. Take opened his remarks with a historical review of the field of "metals-joining", tracing development from the blacksmith shop through gas welding, metallic arc and ultimately to the latest method—atomic hydrogen.

In the atomic hydrogen process, an arc is maintained between two tungsten electrodes, which are cooled by streams of hydrogen gas. The process takes its name from the atomic changes which take place in the hydrogen during its passage through the electrical arc and subsequent combustion.

The essentials of equipment required and techniques involved in correct usage were clearly shown in two colour sound films prepared by the General Electric Company.

Mr. Take described the relatively new process as "industrial dynamite" and predicted a bright future for it. While atomic welding does not provide a panacea for all welding troubles, there are certain fields in which its use has many advantages. These fields cover light gauges materials, particularly those which have proved difficult to weld by other processes.

The use of atomic hydrogen welding provides excellent metallurgical control of the weld and adjacent metal and leaves a smooth, slag and scale free surface.

Typical applications involve gas tight welds on rectifier equipment, propellers, exhaust stacks, rear axle housings and petroleum industry piping.

Mr. Take felt that the new tool would have important repercussions in the welding industry in Canada and if fully utilized would do much to improve the quality and reduce the cost of electric welding.

Approximately 50 members and guests were present.

MONTREAL BRANCH

L. A. Duchastel, m.e.i.c. - - *Secretary-Treasurer*
Hyman Schwartz, s.e.i.c. - - } *Branch News Editor*
Eli L. Ilovitch, s.e.i.c. - - }

The **Design and Use of Timber Structures** was the subject of an address given by Mr. Verne Ketchum, an engineer with 35 years' experience in construction, at a pre-season meeting attended by more than 200 persons on Thursday evening, September 27th 1945.

Mr. Ketchum explained how the use of connectors, samples of which he displayed, make joints in timber which rival the efficiency and dependability of riveted joints in steel. A simple joint in a wood column can be made to develop 90 per cent of the basic strength of the material.

He then discussed the advantages of laminated wood, timber members made up of layers not over two inches thick and bonded together with synthetic, resinous or casein glues. Laminated timbers can be made up in flats or in shaped forms. An example of the latter is a single piece ship section consisting of stem, keel and stern-post.

Laminated (as well as ordinary) timber may be protected from rot by creosoting, or from fire by treating the wood. These processes do not affect the strength of the wood or the glues.

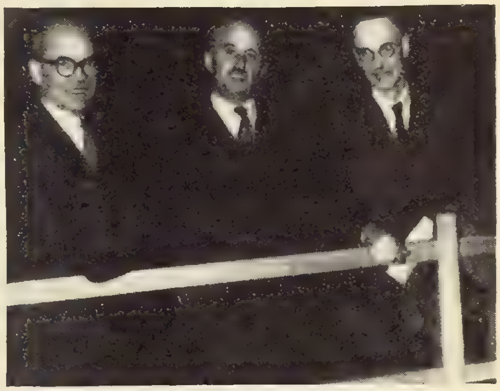
In concluding his address Mr. Ketchum pointed out that it was essentially these developments that made timber structures for hangars, factories and short span bridges a competitor of steel and concrete.

During the discussion period that followed, it was brought out that certain aircraft hangars built in Canada during the war emergency with half seasoned lumber gave considerable trouble due to shrinkage of the wood, but that a proper maintenance scheme overcame the problem.

MONTREAL BRANCH INSPECTS MULBERRY

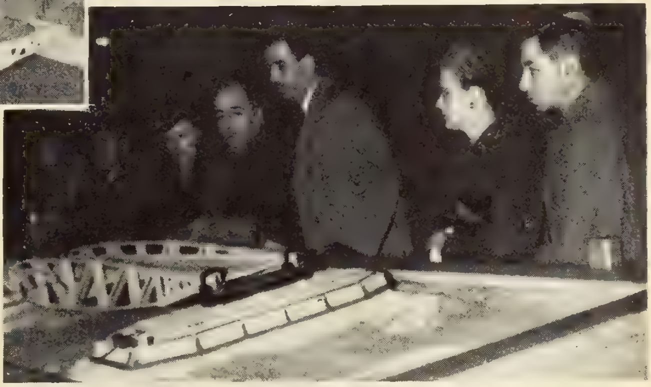
Miss Mary Chadwick; R. E. Chadwick, president of Foundation Company of Canada Limited; R. F. Shaw, also of Foundation Company; and Mrs. Chadwick.

Lieut. Col. C. W. Glover of the War Office was assailed with questions from all sides.



J. A. Lalonde, Huet Massue, A. T. Bone.

(Above) I. R. Tait, chief engineer of Canadian Industries Limited, explains it to his son, Leslie, an engineering student at McGill University.



(At right) Morris Fast wonders why the bridge span for the floating roadway is anchored off centre on the float. Next to him Maurice Frigon and Mrs. Fast.

A coloured film on the construction of wood blimp hangars for the United States Navy was also shown.

W. G. Hunt in thanking the speaker, emphasized with the aid of a humorous anecdote the importance of understanding local conditions before deciding whether wood, concrete or steel should be used for a given structure.

D. A. Armstrong was the chairman of the evening.

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The Opening Meeting of the Montreal Branch was held at Headquarters on the evening of October 4th 1945. The chairman of the Branch, J. B. Stirling, opened the meeting with the reminder that this was the first opening meeting in 7 years that we have not been at war. He stated that the war just ended was an engineers' war and he expected that the period to follow would be an engineers' peace. He then introduced the speaker of the evening, Dr. L. Austin Wright.

Dr. Wright, who is general secretary of the Institute since 1938, began his talk with a humorous lament on the trials and tribulations of being a secretary, after which he reported on the activities of the organization. Committees are doing a valuable service to the Institute and the committee chairman deserve special mention because of the time and energy that they put into their work, said Dr. Wright. The Rehabilitation Department of the E.I.C., which has been instrumental in bringing together prospective employers and engineers, is contacting men in the services who will soon be returning to industry and the profession. Dr. Wright pointed out that an Employment Service was needed for the members of the E.I.C. and it was only a lack of funds that kept the Institute from expanding its field of action. It was thought that the present membership of 7,000 would have to be increased if the dues of individual members were to remain at their present low level.

S. R. Banks was in charge of entertainment which consisted of movies and refreshments. A German language film showing the state of the concentration camps at the time of American entry into Germany was the special feature. "The Bailey Bridge", "Salmon Run", and the "Bridge to South America", were other films shown.

D. G. Elliot thanked the speaker for his enlightening remarks on the affairs of the Institute and voted that a round of applause be given Dr. Wright for his splendid work. Dr. A. E. Cameron, president of the Canadian Institute of Mining and Metallurgy was present and brought greetings from his group.

NIAGARA PENINSULA BRANCH

P. A. Pasquet, Jr. e.i.c. - *Secretary-Treasurer*
J. L. McDougall, m.e.i.c. - *Branch News Editor*

The September meeting of the Niagara Peninsula Branch was held on September 27th, 1945, at the Leonard Hotel, St. Catharines, Ontario, J. H. Ings, branch chairman, presided and J. Hvilivitzky introduced the guest speaker, Mr. Morley Lazier.

Mr. Lazier presented a very interesting and educational address on **Atomic Energy.** As far as is permitted by the secrecy which at present surrounds this topic, he outlined the research which preceded the development of the atomic bomb, the tremendous potentialities of this instrument of war, and its limitations. Mr. Lazier also explained why the atomic bomb is so effective in completely destroying life and material installations within its zone of action due to its tremendous concussion effect, followed by a thermic wave which reaches temperatures of hitherto unthought of heights. At the completion of his formal address, Mr. Lazier joined in a general discussion on the subject and answered all questions which he felt could be answered without revealing information of a secret nature.

W. M. Newby then thanked Mr. Lazier on behalf of all the members present.

At the executive meeting held after the close of the general meeting, several items of business, including the reports of the Membership and Finance Committees, were discussed. Plans were also made for general meetings for the coming year.

LONDON BRANCH

A. L. Furanna, m.e.i.c. - *Secretary-Treasurer*
G. N. Scroggie, m.e.i.c. - *Branch News Editor*

On the evening of September 19th, in the P.U.C. Board Room, the London Branch got away to a very good start this fall when their chairman, H. G. Stead, spoke on **A Review of Welding Processes.** Mr. Stead is president and chief engineer of E. Leonard and Sons Limited, and has had much experience in dealing with welding problems in supplying such projects as the Polymer Corporation at Sarnia.

The speaker covered his subject in a manner that made it of real interest to members in all branches of engineering, using charts, diagrams and blackboard sketches. In tracing the history of welding from the blacksmith to the welding engineer, the speaker stressed the fact that a full understanding of physics, chemistry and metallurgy was required of those who are advancing welding methods, and that there are all too few of these men in this field of work.

Following a question period, E. V. Buchanan thanked the speaker.

The meeting was well attended and the Branch was glad to welcome back so many of its members who have recently returned from service with the Armed Forces.

OTTAWA BRANCH

C. G. Biesenthal, Jr. e.i.c. - *Secretary-Treasurer*
R. C. Purser, m.e.i.c. - *Branch News Editor*

On the evening of September 26th, 1945, an illustrated lecture on timber structures and products was given before the Ottawa Branch by Mr. Verne Ketchum, of Timber Structures Inc., New York. The meeting was held in the National Museum and was well attended.

The speaker described how wood is prepared while being made suitable for beams, fasteners and many other articles used in the making of bridges and other large structures. He further told how lumber had been used as a substitute for steel during the war years, and of the treatment used in making lumber both water and fireproof.

Mr. Ketchum was introduced by the chairman, Norman Marr.

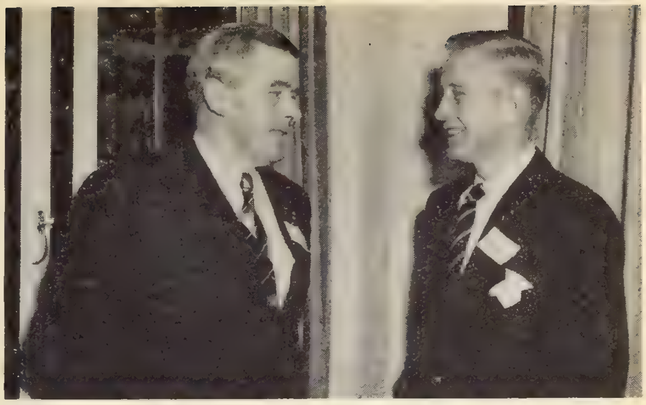
PETERBOROUGH BRANCH

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

A joint meeting of the Toronto Branch of the A.I.E.E. and the Peterborough Branch of the E.I.C. was held on September 29th, at the Kawartha Golf and Country Club. The members registered at 2.00 p.m. and for the balance of the afternoon some enjoyed themselves playing golf or horseshoes, while others were taken on conducted tours of the wire and cable department of the Canadian General Electric Company. Eighty-one persons were present for dinner in the evening.

Mr. J. P. Watts, of the wire and cable engineering department, was the speaker of the evening. His topic was **Some Aspects of Insulating Electrical Conductors.** He was introduced by Mr. J. Cameron, managing engineer of the wire and cable department, who made some general remarks on the history of insulation of electrical conductors and the manufacture of wire and cable at the Peterborough Works of the C.G.E. where the first insulated cable was produced in 1899.

Sing-song at Kawartha Golf and Country Club during joint meeting of the Toronto Branch of the A.I.E.E. and the Peterborough Branch of the E.I.C.



Left to right: J. Cameron, past-chairman of the Peterborough Branch and managing engineer of the wire and cable department of Canadian General Electric Company; J. P. Watts of the wire and cable engineering department.

Mr. Watts described processes and equipment of the department, using slides for illustration. A flow chart for standard lines was used to show the various processing paths, through which the fundamental raw materials may flow, to produce particular classes of cable.

Specialized processes and their related machines were described in relation to the flow chart. Mr. Watts covered Formex machines, Banbury mixers, rubber mill rolls, bunchers concentric stranders, wrapping machines, tubers, tapers, vulcanizing equipment, application of varnished cambric tape, Deltabeston carding, cable closing machines, braiding machines, impregnating equipment for asphalt compounds, lacquer and paint towers, lead extruding presses, together with specialized test equipment for wet and dry tests. He showed by means of the flow chart how these processes and others could be combined to produce many varieties of insulated wires and cables. Thus, the department whose specialized machines were described is able to manufacture a wide range of types and sizes ranging from fixture wire to large power cables.

One of the points of interest brought out by the speaker under lead presses was that when a particularly fine finish is required for a rubber covered cable, it may be vulcanized in lead. This method consists of extruding a lead sheath tightly around the unvulcanized rubber to use the lead sheath as a mould. The sheathed cable is placed in the vulcanizer and heat is provided by steam. Pressure is provided by the lead tightness and expansion of the rubber compound inside the sheath restriction. In this process after vulcanization is complete, the sheath is stripped off, and may be used again.

Following the presentation of the paper, there was a question and discussion period. Mr. O. Titus of the Canada Wire and Cable Company moved a vote of thanks to the speakers.

QUEBEC BRANCH

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

Mardi le 25 septembre les membres de la section de Québec de l'E.I.C. assistèrent à une réunion conjointe du Canadian Institute of Mining and Metallurgy et de l'Institut de Chimie du Canada pour entendre le professeur F. Rasetti, Directeur du Départment de Physique à l'Université Laval, traiter du sujet **Radio-activité artificielle et réactions nucléaires à chaines.**

La bombe atomique a suscité de par le monde beaucoup d'intéret et le fait que le Canada possède, à notre connaissance, la plus grande quantité d'uranium ont été les raisons pour lesquelles il y eut une belle assistance.

SAGUENAY BRANCH

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

A meeting of the Junior Section of the Saguenay Branch was held on October 11th, 1945. The chairman, B. L. Davis, introduced the speaker of the evening, Mr. T. A. Carter, of the Aluminum Company of Canada, Limited, Arvida, who chose the topic **Some Aspects of Engineering in India.**

Mr. Carter spoke on engineering difficulties which were peculiar to that country. He started with the problem of designing in which it was found that Canadian and American hand-books were useless, since all the engineering standards used in India were based on English standards. Shapes and sizes of structural pieces were different from those used in this country; clearances and tolerances were different. In the use of drawings the nomenclature was also entirely different.

In the designs of buildings the weather had to be taken into account. It was found that the temperature remained between 80 deg. and 98 deg. The humidity varied from 15 per cent in the dry periods to from 60 to 100 per cent in the monsoon periods. The precipitation was 120 in. per year and had been known to fall at the rate of 5 in. in twenty minutes. Structures had to be designed for a twenty-four pound wind.

With respect to footings, the earth would support over 8 tons per sq. ft. in the dry state, but would support only 1 ton per sq. ft. when wet. Water intakes and discharges had to be designed to allow for a rise in river elevation of 14 feet in 12 hours.

Due to the high temperature, ventilation was important. Louvres were constructed outside the windows and built to extend below the sill level, to prevent the water blowing in. Windows were hinged to open completely, and doors were unusually large. " Chuggas ", reinforced concrete slabs projecting above the windows, were built to prevent the direct sunlight entering the windows during the middle of the day.

The bricks used were soft and porous, which meant that the panels had to be smaller and the walls plastered inside and out. Due to the high humidity the wood would warp and the glue would soften on sandpaper. The result was that anything affected by moisture had to be kept in special heated cabinets.

Ants would attack any wood not containing pitch, with the result that teak was almost the only variety of wood used. Rats had been known to chew a lead sheath off the cables to obtain the paper filler, so the cables had to be protected with a jute wrapping covered with pitch. Snakes caused considerable trouble around the building and in the switch-yards until it was found that they would not cross crushed rock.

Labour was exceedingly cheap, and it was more economical to use hand labour than to import power machinery. All earth moving was done by hand. All the crushed rock was broken and transported by hand. All lumber used was also cut by hand, and the sand required was taken by hand from the river bed.

The language presented very little difficulty, since an amazing number of the people could speak English. Weights, measures and money on the other hand were a constant source of confusion, due to the various types and standards in use. Rail transportation was slow due to the use of three different gauges requiring trans-shipment. Road transportation was used extensively and water transportation was effective and economical.

A vote of thanks to the speaker was moved by J. G. Campbell.

B. E. Bauman, chairman of the Saguenay Branch then called a general meeting to discuss proposals submitted by the Membership and Finance Committees of the Institute.

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.

General Account of the Development of Methods of Using Atomic Energy for Military Purposes under the Auspices of the United States Government, 1940-1945:
By H. D. Smyth. Wash., Government Printing Office, 1945. 6 x 9 in., 182 pp., illus., 35c.

History of the Kodak and Its Continuations:
By Mina Fisher Hammer. N.Y., House of Little Books, 1945. 6¼ x 9½ in., 95 pp., illus., $2.00.

Making Patent Drawings:
By Harry Radzinsky. N.Y., Toronto, Macmillan, 1945. 7¾ x 10 in., 96 pp., illus., $4.00.

Manual de l'Arpenteur-Géomètre:
Corporation des Arpenteurs-Géomètres de la Province de Québec, 1930. 6 x 8¼ in., 401 pp.

Portable Novels of Science:
Edited by Donald A. Wollheim. N.Y., Viking Press, Toronto, Macmillan, 1945. 4½ x 6½ in., 737 pp., $2.75.

Short Dictionary of Architecture:
By Dora Ware and Betty Beatty. N.Y., Philosophical Library, Toronto, McLeod, 1945. 5½ x 8¼ in., 109 pp., illus., $2.75.

PROCEEDINGS, TRANSACTIONS, REPORTS, ETC.

Alberta—(Prov.)—Department of Lands and Mines:
Annual Report, 1944.

Canada—Department of Mines and Resources:
Petroleum Fuels in Canada, 1944.

Canadian Broadcasting Corporation:
Annual Report, 1944.

Canadian Electrical Association:
Proceedings of the 55th Annual Meeting, 1945.

Corporation of Quebec Land Surveyors:
Annuaire, 1944.
Membership list, 1945.
Rules and Regulations respecting the Admission to the Study and Practice of Land Surveying, 1945.

Kenya and Uganda Railways and Harbours:
Report of the General Manager on the Administration of the Railways and Harbours, 1944.

Quebec (Prov.)—Department of Trade and Commerce:
Statistical Year Book, 1944.

Sir George Williams College:
Announcement, Day and Evening Divisions, 1945-46.

TECHNICAL BULLETINS, ETC.

Asphalt Institute—Construction Series:
No. 72—Manual on Hot-Mix Asphaltic Concrete; the Pavement for Heavy Duty, Unlimited Traffic on all Primary and Interregional Highways. 1945.

Canadian Standards Association:
C22.2—No. 8—1945. Construction and Test of Suppressors for Radio Interference. (Canadian Electrical Code, Part 2.)

Codes of Practice Committee—British Standard Code of Practice:
CP (B) 491—Foundations and Sub-Structure. CP (B) 489—Hot Water Supply by Gas for Single Family Dwellings.

Cornell University—Engineering Experiment Station: Bulletin
No. 34 — Performance Characteristics of Commercial Home Freezers. By James R. Donnalley, Jr. 1944.

Electrochemical Society—Preprints:
88—4—Electric Conductivity of Molten Chloride Salts by Elizabeth K. Lee and Edward P. Pearson. 88—5—Electrodeposition of Metals on Plastics by Harold Narcus. 88—6—Electrodeposition of Vinyl Plastics by Morris Feinleib.

Highway Research Board—Wartime Road Problems:
No. 11—Compaction of Subgrades and Embankments. 1945.

Illinois—University—Engineering Experiment Station: Bulletin Series:
No. 353—Analysis of the Motion of a Rigid Body by Edward W. Suppiger. No. 357—Bonding Action of Clays—Part 1—Clays in Green Molding Sand . . . by Grim and Cuthbert. No. 358—Study of Radiant Baseboard Heating in the I-B-R Research Home by Alonzo P. Kratz and Warren S. Harris.

Quebec (Prov.)—Department of Lands and Forests—Forest Service:
Bulletin
No. 6—Etude de Quelques Propriétés des Charbons de Bois du Québec se Rapportant à leur Utilisation comme Carburant dans les Gazogènes by Jos. Risi. No. 7 — Etude du Mécanisme de Carbonisation de Quelques Espèces de Bois de la Province de Québec by Jos. Risi. No. 8—La Fabrication du Charbon de Bois by Jos. Risi. No. 9—Etude des Huiles Essentielles Tirées des Feuilles de Quelques Conifères du Québec by Jos. Risi.

United States—Department of the Interior: Geological Survey Bulletin:
945-D—Tungsten Deposits in Beaver County, Utah. 946-A—

Manganese and Iron Deposits of Morro Do Urucum Mato Grosso, Brazil.

Geological Survey Water-Supply Paper:

919—Ground-Water Resources of the El Paso Area, Texas. 976—Surface Water Supply of the United States, 1943, Part 6—Missouri River Basin. 980—Op. cit., Part 10—The Great Basin. 983—Op. Cit., Part 13—Snake River Basin.

Universal Oil Products Company:

Reprint Series:

No. 259—Problems of the Scientific Literature Survey; Problems of Scientific Literature Research; Scholastic Training for a Career in Chemical Literature Research by Gustav Egloff, Mary Alexander, Prudence Van Arsdell.

PAMPHLETS

Atom; New Source of Energy:

McGraw-Hill Publishing Co., 1945.

Beauty in Bridges:

By E. B. Steinman. (Reprinted from The Hudson Engineering Journal.)

Code of Minimum Requirements for Instruction of Welding Operators; Part A—Arc Welding of Steel 3/16 to ¾-in. Thick.

Prepared by Committee on Minimum Requirements of Instructions for Welding Operators in Trade Schools. American Welding Society, 1945.

Conference on Unification of Engineering Standards:

Combined Production and Resources Board, Sept.-Oct. 1945.

Electronics and the Chemical Industry:

By J. A. Hutcheson. (Reprinted from Canadian Chemistry and Process Industries, March 1945.)

Employment and Income with Special Reference to the Initial Period of Reconstruction:

Minister of Reconstruction. Ottawa, Kings Printer, 1945. (French and English editions.)

From British Heritage to American Achievement in Engineering:

By Robert M. Gates. (Newcomen Address), 1945.

Gas Turbine Power Plant; Now a Reality:

Elliott Company, 1945.

Record of British War Production:

London, The Times, 1945.

Report of Conferences on Standardization of Screw Threads and Cylindrical Fits:

London, Combined Production and Resources Board, August-September, 1944.

Romance of Electricity:

Toronto, Canadian General Electric, 1945.

Solution Pratique et Economique au Problème de la Circulation dans les Grands Centres Métropolitains:

By Adrien Genest. Montreal, 1945.

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

DISTRIBUTION OF THUNDERSTORMS AND THE FREQUENCY OF LIGHTNING FLASHES; A Review, Second Edition Revised and Enlarged

By R. Reudy. Ottawa, National Research Council, 1945, 70 pp., illus. (N.R.C. No. 1282.)

The report reviews the investigations carried out, mainly during the past decade or two, on the distribution of lightning storms and the frequency of lightning flashes as far as they may affect the operation of high-voltage lines.

FUNDAMENTALS OF INDUSTRIAL ELECTRONICS

By G. M. Chute. Toronto, Canadian General Electric Co. Ltd. 1945. 40 pp., illus.

This is a reprint of eight articles by G. M. Chute, Application Engineer, General Electric Co., which appeared in *Steel*, April 3rd to May 22nd, 1944.

The application, use, and proper maintenance of the many electronic equipments now in industrial use demand a certain familiarity with the fundamentals of circuits used in various standard electronic equipments. These articles have been prepared with this need in mind.

HIGH PRESSURE DIE CASTING; A Design Guide for Engineers, 1st ed.

By H. L. Harvill and Paul R. Jordon. Vernon, Calif., H. L. Harvill, 1945. 130 pp., illus.

The primary subject of this volume is the cold chamber high pressure process. The development of this technique of die casting is a recent one. The cold chamber method became widely used in the early 1930's as a result of an increasing demand for die castings of copper, aluminum and magnesium base alloys. The study of this method must of necessity encompass a study of the technique, the equipment—including a detailed analysis of die design factors, the materials used and those elements of casting design which influence the satisfactory production of the end product. It is therefore the purpose of this book to document these factors in the interest of increasing the use of the die casting method and the efficiency of die casting part design.

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 ON CONCRETE AND CONCRETE AGGREGATES

Prepared by A.S.T.M. Committee C-9 on Concrete and Concrete Aggregates; Specifications, Methods of Testing, Definitions; July, 1945. American Society for Testing Materials, Philadelphia, Pa. 141 pp., illus., diagrs., tables, 9 x 6 in., paper, $1.50.

This pamphlet brings together the specifications and test methods for concrete and concrete aggregates, together with other pertinent standards covering cement, concrete reinforcement, preformed expansion joint fillers and sieves for testing purposes.

AIRCRAFT YEAR BOOK FOR 1945, 27th Annual Edition

Howard Mingos, Editor, official publication of Aeronautical Chamber of Commerce of America, Inc., publ. by Lanciar Publishers, Inc., 10 Rockefeller Plaza, New York, 1945. 688 pp., illus., diagrs., tables, 9 x 5½ in. cloth, $6.00.

This Year Book, sponsored by the Aeronautical Chamber of Commerce, provides a review of important events in aviation during the last year. The work of the Army and Navy, the development of airports and airways, progress in equipment and other matters of interest are discussed. Statistics and directories of aviation organizations, manufacturers and government agencies are included.

BIBLIOGRAPHY ON CUTTING OF METALS 1864-1943

Prepared by O. W. Boston. Publ. by American Society of Mechanical Engineers, 29 West 39th St., New York, 1945. 547 pp., 8½ x 5½ in., cloth, $6.50.

More than four thousand items are listed in this invaluable compilation for the machine tool designer and user. The main list is chronological and covers the period from 1864 to 1943. There is an author index to the list, and a subject index is so tabulated that for any particular cutting process the items referring to the various types of tools, to cutting fluids, speeds and feeds, chip formation, finish, wear, etc., may be readily found.

BUDGETING FOR MANAGEMENT CONTROL

By F. H. Rowland and W. H. Harr. Harper & Brothers, New York and London, 1945. 378 pp., diagrs., charts, tables, 9½ x 5½ in., cloth, $4.00.

Budgetary control is presented as an over-all management tool, and is explained by assuming a mythical company and applying the recommended principles to its operation. The book shows how to prepare a budget on an annual basis and adjust this annual plan in terms of day to day conditions. Full descriptions with pictured illustrations are given of a system of reports through which executive, managerial and operating heads may assess current conditions and effectively plan a sound and profitable future.

CALCIUM METALLURGY AND TECHNOLOGY
(American Chemical Society Monograph 100)

By C. L. Mantell and G. Hardy. Reinhold Publishing Corp., New York, 1945. 148 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $3.50.

The opening chapters cover the properties and production of calcium. Succeeding chapters describe the constitution, properties and uses of the important alloys containing calcium and of calcium hydride, and point out the particular value of calcium in these combinations. The uses of calcium in the petroleum industry and in the production of certain metal powders are also discussed.

CHEMICAL FORMULARY, Vol. VII

Edited by H. Bennett. Chemical Publishing Co., Brooklyn, N.Y., 1945. 474 pp., tables, 9 x 5½ in., cloth, $6.00.

Some 2,000 formulae are presented in the latest volume of this series. A wide range of topics from adhesives to zinc solutions for rust prevention is covered, with practical directions for compounding in most cases. As with the rest of the series, none of the formulae have appeared in previous volumes. There is a list of sources of chemicals and supplies not readily available.

CHEMISTRY OF LEATHER MANUFACTURE (A.C.S. Monograph 101)

By G. D. McLaughlin and E. R. Theis. Reinhold Publishing Corp., New York, 1945. 800 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $10.00.

Experimental evidence and pertinent data are presented with regard to the chemical reactions necessary or incident to the many operations involved in the manufacture of leather. The included material is designed primarily to summarize and to appraise present scientific knowledge of the conversion of animal skin into leather. The various tannery processes are taken up in order, with separate chapters on the histology, composition and chemical structure of skin, the microörganisms involved in tanning, and physical testing methods. There are several hundred references to additional material.

CONTROLLERS FOR ELECTRIC MOTORS

By H. D. James and L. E. Markle. McGraw-Hill Book Co., 1945. 324 pp., illus., diagrs., charts, tables, 9 x 5¾ in., cloth, $3.50.

The construction, performance and operation of all types of commercial motor controls in general use are described. Protective devices are explained in detail, and brief instructions for installation and maintenance are included. Special control systems, such as for elevators, steel mills, etc., are not considered. The book is intended for technical students as well as for operating man and application engineers, and the treatment is such that only a limited knowledge of electric motors is required.

CYCLE A DEUX TEMPS, étude cinématique et thermique.

By J. Jalbert. Dunod, 92 Rue Bonaparte, Paris (VI), 1944. 134 pp., illus., diagrs., charts, tables, 8½ x 5½ in., paper, 72 frs.

This interesting little work discusses the two-stroke cycle from the thermodynamic points of view. The author first studies the possible methods of charging, independently of their mechanical possibilities, and points out the thermodynamic results with each. He then studies ways in which each method of charging might be accomplished and the resulting advantages and disadvantages with respect to power, cost of manufacture and operation and the field in which each method promises success. Finally, the characteristics of two-cycle engines are studied from the kinematic point of view.

ELECTRICAL POWER USES IN MARINE SERVICE (Marine Electricians' Library, Vol. 3)

By J. M. Dodds. McGraw-Hill Book Co., New York and London, 1945. 444 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $4.00.

This volume presents the fundamentals of the ordinary incandescent lamp, as well as new applications of electrical principles in modern lamp sources. It also discusses the various new lamps for shore plant and marine use, such as mercury vapor lamps, marine searchlights, and the fluorescent lamp in illumination. The electrical propulsion of ships is discussed under two divisions: direct current for the relatively small power plant, and alternating current for the larger ship propulsion plant.

ELECTROMAGNETIC ENGINEERING, Vol. I, Fundamentals

By R. W. P. King. McGraw-Hill Book Co., New York, 1945. 580 pp., diagrs., charts, tables, 8½ x 5¼ in., cloth, $6.00.

This first volume of a three-volume series offers a systematic introduction to basic concepts of electromagnetism which are fundamental in the study of electromagnetic waves, antennas, electromagnetic horns, wave guides, ultra-high frequency and microwave circuits. The physical and mathematical essentials of electrodynamics are logically developed and critically discussed for the purpose of application to engineering problems.

ELEMENTARY ELECTRIC-CIRCUIT THEORY

By R. H. Frazier, McGraw-Hill Book Co., New York and London, 1945. 434 pp., diagrs., charts, tables, 8½ x 5¼ in., cloth, $4.00.

Intended as a complete elementary exposition of electric-circuit theory requisite in the technical foundation of all students of electrical engineering regardless of their expected branches of specialization—power, communications or electronics. The book calls for a knowledge of physics and mathematics that is usually acquired by the end of the sophomore year.

EXPERIMENTAL STRESS ANALYSIS, Proceedings of the Society for Experimental Stress Analysis, Vol. 2, No. 2

Published and distributed by Addison-Wesley Press, Kendall Square, Cambridge, Mass., 1945. 166 pp., illus., diagrs., charts, tables, 11¼ x 8½ inl, cloth, $5.00.

This semi-annual publication contains the major portion of the papers delivered at the meetings of the Society. The first eleven papers of the present issue deal with a variety of topics —fatigue resistance, plastic flow problems, analogic experimental methods in stress analysis, residual stresses, etc. The last four papers were contributed to a special symposium on crankshaft stresses.

GEOLOGY OF MISSOURI (University of Missouri Studies, Vol. 19, No. 3)

By E. B. Branson. University of Missouri, Columbia, Mo., 1944. 535 pp., illus., diagrs., charts, maps, tables, 10½ x 7¼ in., paper, $3.00.

The greater part of this detailed study is devoted to the stratigraphic geology of the region with extensive paleontological information. Brief treatments of general topography and structural geology are followed by some forty pages on the economic geology of Missouri dealing with soils, water resources, petroleum and natural gas, clays, coal, stone products and ore deposits. An extensive ninety-page bibliography is appended.

Great Britain, Ministry of Works. DEMONSTRATION HOUSES

Publ. by His Majesty's Stationery Office London, 1944. 76 pp., illus., diagrs., tables, 8½ x 5½ in., paper, 1s. (obtainable from British Information Services, 30 Rockefeller Plaza, New York 20) 30c.

This booklet gives a short account of a series of houses built by the British Ministry of Works for the purpose of estimating probable post-war costs for certain methods of house building. The two main types of construction covered are steel-frame with various outer coverings and poured concrete. Interior planning is discussed, and there is a brief note on emergency housing.

HISTORY OF PHOTOGRAPHY

By J. M. Eder, translated by E. Epstean. Columbia University Press, New York, 1945. 860 pp., tables, 9¼ x 6 in., cloth, $10.00.

This comprehensive historical treatise is a translation of the 4th edition, 1932, of the original German work, and carries through the first quarter of the twentieth century. It begins with an examination of the rudimentary knowledge of light and its properties held by the ancient Greeks and Romans, and proceeds, century by century, through the discoveries and contributions of individuals from many nations. All of the special processes and applications within the period involved are included, and a separate chapter presents a survey of the important photographic journals, societies and educational institutions.

HOW TO SOLVE IT, a New Aspect of Mathematical Method

By G. Polya. Princeton University Press, Princeton, New Jersey, 1945. 204 pp., diagrs., tables, 8 x 5¼ in., cloth, $2.50.

A simple, logical general method for the solution of problems is presented. The illustrative material is largely mathematical, but the method is applicable in principle to many scientific, engineering, or even social problems.

MACHINE TOOL GUIDE Engineering Data, covering the Principal Machine Tools, especially prepared for tool engineers, millwrights, and tool equipment salesmen.

American Technical Society, Chicago, 1945. 702 pp., illus., diagrs., charts, tables, 11 x 8 in., cloth, $7.50.

This work brings together in a single volume data hitherto available only in the catalogs and service manuals of individual machine-tool manufacturers. Drawings, specifications, dimensions, speeds, feeds and other information provided by sixty-one leading manufacturers are given for the automatics, boring machines, drilling machines, lathes, milling machines, etc., made by these firms. The material is classified for convenient reference.

MANUAL OF INSTRUCTIONS ON PROPER FIRING METHODS in the interest of Fuel Combustion and Conservation, Air Pollution, Smoke Elimination

Smoke Prevention Association of America, Inc., 139 North Clark St., Chicago 2, 1945. 72 pp., illus., diagrs., charts, tables, 11 x 8½ in., paper, mimeographed, limited free circulation with 25c. mailing charge.

Ten articles by various authors are contained in this manual. The following topics are dealt with: fuel conservation; furnace turbulence; fuel oil and its combustion; furnace dimensions for underfeed stokers; domestic heating with coke; hand-firing coke; smoke reduction in industrial boiler firing; interpreting coal analyses; excerpts from S.M.A. technical manual; instructions for burning low volatile coal.

MARINE ELECTRIC POWER

By Q. B. Newman. 3 ed. Simmons-Boardman Publishing Corp., New York, 1945. 244 pp., diagrs., charts, tables, 7¾ x 4¾ in., cloth, $2.50.

Avoiding the use of mathematics and physics, this elementary text covers the essentials of electrical theory, the principles of electrical engineering and the use of electrical equipment on shipboard. The extensive use of simple illustrative diagrams increases the practical value of the book.

MEANING OF RELATIVITY

By A. Einstein. Princeton University Press, Princeton, New Jersey, 1945. 135 pp., diagrs., charts, tables, 8 x 5½ in., cloth, $2.00.

This is a reissue of Mr. Einstein's classic presentation of his theory of relativity. It is intended for the general reader who has some understanding of modern physics and advanced mathematics. The subject of space and time in pre-relativity physics is discussed as well as the special and general relativity theories. An appendix, covering significant advances in this field since 1921, has been included in this new edition.

PIPING HANDBOOK

By S. Crocker. 4th ed. McGraw-Hill Book Co., New York and London, 1945. 1,376 pp., illus., diagrs., charts, tables, 7¼ x 4½ in., cloth, $7.00.

This standard work makes available under one cover a compilation of data for the effective design and use of piping in all its engineering and industrial applications, from water distribution to hydraulic systems for aeroplanes. The book authoritatively covers scientific fundamentals, materials, design and installation practice, and many useful construction details. Cost analyses, standards, definitions and references to additional sources are also included. Separate chapters are devoted to closely allied topics such as pumps and corrosion.

PLASTICS

By J. H. DuBois. American Technical Society, Chicago, 1945. 447 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $4.00.

That this book, first published in 1942, has now reached its third edition, is an indication of the rapid advances in its field. It affords a simple, clear explanation of the manufacture of the more important plastics, discusses the manufacturing problems of each, and their principal applications. The book is intended primarily for users of plastics.

PRINCIPLES OF RADIO

By K. Henney. 5th ed., John Wiley & Sons, New York; Chapman & Hall, London, 1945. 534 pp., illus., diagrs., charts, tables, 8 x 5¼ in., cloth, $3.50.

The opening chapters present the fundamentals of electricity and the basic properties of direct-current and alternating-current circuits. Succeeding chapters deal with the essential elements of radio operation; vacuum tubes, condensers, rectifiers, amplifiers, antennas, etc. Frequency modulation, ultra-high-frequency phenomena, and electronic instruments are briefly discussed. The material is designed for self-study and for the student with little background in radio.

ROLLING BEARINGS

By R. K. Allan. Sir Isaac Pitman & Sons, London; Pitman Publishing Corp., New York, 1945. 401 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, $8.50 (30s. abroad).

This comprehensive work includes a detailed account of the history of the subject, followed by basic information or bearing elements and materials. The author then develops the Hertzian theory as specifically applied to bearings, and deals fully with the work of Stribeck, Goodman and Palmgran. Typical and unusual bearings are described in Section VIII. In Section IX to XV practical matters as distinct from bearing design are discussed, such as bearing selection and application, lubrication and maintenance. There is a considerable bibliography.

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.

SAMPLING STATISTICS AND APPLICATIONS (Fundamentals of the Theory of Statistics)

By J. G. Smith and A. J. Duncan. McGraw-Hill Book Co., New York and London, 1945. 498 pp., diagrs., charts, tables, 8½ x 5¼ in., cloth, $4.00.

After reviewing basic concepts and definitions, the authors discuss the general theory of frequency curves and the theory of random sampling. Important sampling distributions are derived, and their applications to a variety of problems are illustrated. Both exact and approximate sampling methods are considered with their proper fields of use. The character of assumption involved in theory is explicitly treated, and the problems that such assumptions present in practical applications are illustrated.

SPHERICAL TRIGONOMETRY after the Cesâro Method

By J. D. H. Donnay. Interscience Publishers, Inc., New York, 1945. 83 pp., diagrs., tables, 7½ x 4¾ in., cloth, $1.75.

The Cesaro method offers a novel presentation of spherical trigonometry that ties together the concepts of spherical and plane trigonometry in a way that enables the student to obtain a working knowledge of the subject in minimum time. This booklet, based on long teaching experience, is a brief introduction.

SIMPLE CALCULATION OF ELECTRICAL TRANSIENTS

By G. W. Carter. University Press, Cambridge, England; Macmillan Co., New York, 1945. 120 pp., diagrs., tables, 8¼ x 5¼ in., cloth, $1.75.

This small volume provides an elementary treatment of transient problems by Heaviside's operational method in linear electrical circuits with lumped elements. The emphasis is on the physical or engineering side, and many worked examples are given, based on real engineering or laboratory problems. The basic algebra and calculus necessary for a proper understanding of the book have been included in appendices for those who need the information.

Translation Key to KLEINLOGEL'S RAHMENFORMELN

By F. S. Morgenroth. Frederick Ungar Publishing Co., New York, 1945. 49 pp., 9¼ x 6 in., cloth, $1.25.

Kleinlogel's collection of formulas provides the designer with ready-to-use formulas for all the static stresses in frames. It has gone through eight editions in Germany and has been republished in this country. The present book will facilitate its use by engineers whose knowledge of German is slight, as it supplies translations of the important parts of the text.

UNITED STATES NAVAL ACADEMY, the First Hundred Years

By J. Crane and J. F. Kieley. McGraw-Hill Book Co., Whittlesey House Dept., New York, 1945. 53 pp. text, 300 photographs, 3 in full color, 10 x 7¼ in., cloth, $5.00.

This work commemorates the centenary of the United States Naval Academy at Annapolis. The story is told chiefly in pictures, there being over 300 photographs of scenes and men connected with the place. The text briefly sketches the history of the school.

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

October 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 December 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 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

ADAMS—EDWARD CAMPBELL, of 381 Grosvenor Avenue, Westmount, Que. Born at Springhill, N.S., Feb. 9th, 1913. Educ.: B. Eng. (Elect.), Nova Scotia Tech. Coll., 1936; 1937-41, jr. engr. on elect. constrn. and mtce., electrical dept., Dominion Iron & Steel Co., Sydney, N.S.; 1936-37, (4 mos.), bituminous paving inspectr., Milton Hersey Co., Montreal, Que.; with Defence Industries Ltd., as follows: 1941-44, asst. res. engr., responsible for all plant mtce., constrn, repairs, C.I.L., Nobel Explosives & Chemical Plant, special duties engr., i/c special engrg. design and constrn., D.I.L., Nobel, Ont., 1944-45, (7 mos.), area engr., i/c mtce. and repairs in acid and nitro-cellulose areas of D.I.L., Nobel, Ont., and at present, design engr. in special projects dept., D.I.L., 625 Dorchester St. W., Montreal, Que.

References: H. W. McKeil, F. L. West, F. H. Sexton, G. H. Burchill, S. J. Ball

ANDERSON—ROBERT MUMA, of 1239 Victoria Ave., Windsor, Ont. Born at Windsor, Ont. Sept. 17th, 1908. Educ.: Lowell Inst., M.I.T., Cambridge, (night school), 1929-34; with B. F. Sturtevant Co., Boston, as follows: 1929-35, mech. dfting., 1935-38, heating, vent. & mech. draft layout work, Galt, Ont., 1938-40, sales engrg., Galt & Toronto, Ont., 1935-36, assisted in design & layout of heating & vent. equipt. for H.E.P.C. Ontario, 1937, assisted in design & layout air conditioning equipt. for Royal Trust Bldg., Toronto and other smaller jobs; 1937 to date, engr. with The DeVilbiss Mfg. Co. of Can., Ltd., as follows: dope room & finishing room, vent. design, with full or partial responsibility on the following jobs: Boeing Aircraft, Can. Car & Foundry, Canadian Vickers, Fairchild, General Motors, Chrysler & Ford, etc., and at present chief engr., Windsor, Ont.

References: G. L. Wiggs, A. T. Hurter, H. H. Angus.

BARNES—JAMES C., of 328 Second Ave., Ottawa, Ont. Born at Gibraltar, April 21st, 1909. Educ.: B.A.Sc., M.A.Sc., Univ. of Toronto, 1931, 1932; R.P.E., Ontario; with H.E.P.C., Ontario, as follows: 1934-37, research engr., 1938-40, asst. engr., transmission dept.; 1941, design engr., Canadian Marconi Co., Montreal; 1942 to date. asst. research engr., National Research Council, Ottawa, Ont.

References: N. Marr, J. E. Breeze, F. A. Sweet, R. W. Boyle, D. S. Smith.

BAXTER—ANDREW, o Calgary, Alta. Born at Hamilton, Lanarkshire, Scotland, Oct. 17th, 1907. Educ.: Cert., Mech. Engr., Royal Technical College, Glasgow, 1929-34; Constantine Tech. College, Middlesborough, 1934-37, Higher National Cert., Institute M. E., London; Ass. Member, Inst. Structural Engrs., London; 1923-29, apprent. dftsman with Campbell Binnie Co., Engrs., Scotland, mech. & structl. experienced in relation to coal, screening, washing & handling plants; 1929-34, dftsman, design & arrangement of coal handling plants for power plant projects, Babcock & Wilcox, Ltd., Renfrew, Scotland; 1934-37, tech. asst., design of chem. plant equipt, particularly, nitric, sulphuric acid & cement plant; 1937 to date, engr., design & arrangement of coal screening & washing plants, Riverside Iron Works, Dominion Bridge Co., Calgary.

References: P. F. Peele, F. C. Tempest, R. Barnecut, E. Avery, R. S. Trowsdale.

BLAYNEY—JAMES PORTER, of Sarnia, Ont. Born at Brantford, Ont. July 12th, 1924. Educ.: B.A.Sc., (Mech.), Univ. of Toronto, 1945; 1942-43, Massey-Harris, Aircraft Divn., Weston, Ont.; 1944, R.C.O.C., summer course, Barriefield, Ont.; 1945, (May to date), jr. engr., genl. plant mtce. and engrg., Dow Chemical of Canada, Ltd., Sarnia, Ont.

References: N. Fodor, C. P. Warkentin, F. F. Dyer, E. W. Dill, E. K. Lewis. R. Neave.

BOGGS—WILLIAM BRENTON, Staff Officer, R.C.A.F., of Noranda, Que. Born at Douglas, Arizona, Dec. 18th, 1918. Educ.: B. Eng., (Mech.), McGill Univ., 1940; 1938, (summer), underground work, running in drifting machine; 1939, (summer), mfg. tools & jigs for Hurricane, Canada Car & Foundry Co.; with R.C.A.F., as follows: Squadron, Station, Wing and Group Engineer Officer, Staff Officer, planning for Pacific, and at present Engr. (Aeronautical) awaiting discharge.

References: T. R. Loudon, R. DeL. French, D. C. MacCallum, A. LeB. Ross, H. Crombie.

CASSON—HAROLD VINCENT, Lieut. (E), R.C.N.V.R., of Cadboro Bay, B.C. Born at Victoria, B.C. May 24th, 1920. Educ.: B.A.Sc., (Elect.), Univ. of British Columbia, 1942; 1936-37, layout instln. of steam & hot water heating plants, J. E. Casson, plumbing & heating; 1941, (5 mos.), thawing asst. engr., Yukon Consolidated Gold Corp; 1942 to date, active service, and at present on annual leave.

References: J. N. Finlayson, D. B. Barry, H. J. MacLeod, A. Peebles, B. R. Spencer, A. A. Buchanan.

COCHRANE—PETER WILLIAM FITZGERALD, Aero. Officer, R.C.A.F., of London, Ont. Born at Titchfield, Hants, England, April 27th, 1916. Educ.: B. Eng., (Mech.), McGill Univ., 1941; 1938-39, (summers), Vickers, (Marine Divn.), Barrow, Lancs. & Weybridge, Eng.; 1940, (summer), Canadian Car & Foundry, (Aircraft), Montreal, Que.; 1941-45, R.A.F., Ferry Command, Draughting Officer, R.C.A.F., Aero. Engr., (Mtce.), and at present awaiting discharge.

References: A. R. Roberts, C. M. McKergow, G. J. Dodds, R. DeL. French, E. Brown.

CRAIG—WILLIAM HARDY, of Sarnia, Ont. Born at Moose Jaw, Sask., Feb. 8th, 1921. Educ.: B. A. Sc., (Mech.), Univ. of Toronto, 1943; R.P.E., Ont.; 1943-45; dftsman and jr. engr., on layout, design and supervision of mtce. and process changes, and at present constrn. supervisor on constrn. of Styron plant, Dow Chemical of Can., Ltd., Sarnia, Ont.

References: E. W. Dill, E. K. Lewis, F. F. Dyer, A. H. Munro, C. P. Warkentin.

DALY—ROBERT EMMET, Capt., R.C.E.M.E., of 6960 Sherbrooke St., W. Montreal, Que. Born at Montreal, Aug. 13th, 1912. Educ. B. Eng., (Chem.), McGill Univ., 1936; with Price Bros. & Co., as follows: 1927-28-29, (summers), survey & genl. engrg. work, road constrn., wheelman, hydro-elect. plant, 1936-39, chemical control, newsprint mill; 1939-42, sales develop. & experimental work on hard surfacing alloys for mtce. work in industrial plants, and vice-pres., 1941-42, Wall Colmonoy Can., Ltd., Montreal; 1943-45, Canadian Army Active, seconded to Automotive & Tank Prod. Br., Dept. of Munitions & Supply.

References: G. E. Lamothe, G. F. Layne. E. C. Perley, R. E. Jamieson, N. O. Carr.

DELAGE—JEAN BAPTISTE, Lieut., R.C.E., of Charlesbourg, Que. Born at Charlesbourg, Que., July 24th, 1917. Educ.: B.Sc., (Mining), Laval Univ., 1941; R.P.E., Quebec; 1936-37, (5 mos.), housing constrn., Komo Construction Ltd.; 1937-38, Sullivan Cons. Gold Mines Ltd.; 1939-40-41, (summers), asst. field geologist, Dept. Mines & Resources, Ottawa; 1942, (8 mos.), asst. engr., Malartic Goldfield Ltd.; 1943 to date, with R.C.E., Sun Life Bldg., Montreal.

References: A. Pouliot, R. Dupuis, G. W. Waddington.

DONALD—ROBERT JOHNSTON, of 113 North College Ave., Sarnia, Ont. Born at Renfrew, Scotland, October 31st, 1912. Educ.: B.A.Sc., and M.A.Sc., Univ. of British Columbia, 1935 and 1936; 1936-37, jr. chemist, Ioco Ref., Imperial Oil Ltd.; with Tropical Oil Co., Barranca, Bermeja, Colombia, S. A., as follows: 1937-38, jr. chemist, 1938-41, asst. & tech. service chemist, 1942, chief chemist, 1943-45, chief chemist & acting asst. supt.; at present, asst. chief chemist, Imperial Oil Ltd., Sarnia, Ont.

References: C. P. Warkentin, G. L. Macpherson, J. W. MacDonald, F. F. Dyer, G. W. Christie, T. S. McKechnie.

GORING—GILMAN ROGERS, Staff Officer, R.C.A.F., of Grand'Mere, Que. Born at Montreal, Que., April 11th, 1915. Educ.: B. Eng., (Mech.), McGill Univ., 1939; with Canadian Fairbanks Morse Co. as follows: 1936:37, engrg. asst., mech. power transmission & machine tool dept., 1938, (4 mos.), asst. to mgr., diesel repair shop supervision; 1939, (4 mos.), mech. engr. under training, Consolidated Paper Corp., Grand-Mere, Que.; 1939-40, (8 mos.), mech. engr. on design and stress analysis of Hoover propellers, Canadian Car & Foundry, Montreal; with R.C.A.F., as follows: 1940-42 Officer i/c Repair Squadron, 1942, (8 mos.), Chief Engr. Officer, Camp Borden, 1942-43, (8 mos.), Chief Engr. Officer, Brantford, 1943-44, (9 mos.), Staff Officer i/c mtce. & engrg. of aircraft, 1944-45, Staff Officer, Air Force Hdqts., Ottawa; and at present asst. to divn. engr., Consolidated Paper Corp., Grand'Mere, Que.

References: K. Y. Lochhead, H. S. Rees, V. Jepsen, E. T. Buchanan, F. W. Bradshaw.

HANRAHAN—FRANK EDWARD, Elect. Lt., R.C.N.V.R., of Ottawa, Ont. Born at Halifax, N.S., March 13th, 1913. Educ.: B. Eng., (Elect.), Nova Scotia Tech. Coll., 1936; 1936, paving inspectr., N.S. Highways, Milton-Hersey Co.; with Engrg. Service Co., (consultg. engrs.), Halifax, N.S., as follows: 1937-38, jr. engr., 1938-41, engr.; 1941 to date wth R.C.N.V.R., N.S.H.Q., Ottawa, Ont.

References: J. R. Kaye, P. A. Lovett, G. V. Ross, S. W. Gray, F. W. R. Angus.

HEMPHILL—JAMES LAIRD, Ltd. Cmdr. (E), R.C.N.V.R., of 71 Fleming Crescent, Toronto, Ont. Born at Toronto, Sept. 11th, 1913. Educ.: B.A.Sc., Univ. of Toronto, 1938; 1935, (summer), elect. mtce., blacksmith & machinist's helper in surface shops & underground; 1936, (summer), sheet metal, punch & brake press work; 1938-39, work in welding shop, foundry blade shop (fabrication & fitting), elect. drawing office & small fitting shop, C. A. Parsons & Co., Newcastle-on-Tyne, England; 1939-42, Royal Navy, initial training; 1942 to date, Royal Canadian Navy, and at present Staff Officer, (Engrg.) to Naval Member, Canadian Joint Staff, Washington, D.C.

References: G. L. Stephens, A. C. M. Davy, C. A. Allcut, W. G.McIntosh, D. L. McGillivray.

HILLARY—BERTRAND BRISTOW, of Sarnia, Ont. Born at Vancouver, B.C., October 15th, 1911. Educ.: B.A., M.A., Univ. of British Columbia, 1934, 1936, Ph. D., Univ. of Toronto, 1939; 1940-41, (summers), genl. supt., i/c dust control work on airports and munitions plants; 1939-41, (winters), research, teaching, consultg. work in chemistry & engrg. studies, Univ. of Toronto; 1942-43, asst. engr. during constrn. synthetic rubber plant, liaison officer between Rubber Research & Polymer for expediting of materials, i/c coordination of plans for lab. and other bldgs., Polymer Corp. Ltd., Sarnia, Ont.; 1943 to date, res. engr. during constrn. Styrene plant, then i/c engrg. & mtce. depts., and at present mtce. & process engr., Dow Chemical of Can., Ltd., Sarnia, Ont.

References: G. Hemmerick, G. L. Macpherson, P. Warkentin, R. W. Dunlop, R. L. Hearn, F. F. Dyer.

HOLMES—THOMAS FREDERICK, 2/Lt., R.C.E.M.E., of Ottawa, Ont. Born at North Bay, Ont., Jan. 22nd, 1920. Educ.: B.A.Sc. ,(Mech.), Univ. of Toronto, 1944; R.P.E., Ontario; 1940-42, (summers), student helper, genl. machine shop, boiler shop, erection shop & testing locomotives, C.P.R., Angus Shops, Montreal; 1943, (summer), dftsman., R.C.A.F., Works & Bldgs., No. 3 Training Comd. H.Q., Montreal; 1944, (4 mos.), asst. surveying engr., field party, Hydrographic Service, Dept. of Mines & Resources, Ottawa; 1944 to date with R.C.E.M.E.

Eeferences: G. R. Lord, W. J. T. Wright, M. A. MacKinnon.

KOCHER—WILFORD J. of Calgary, Alta. Born at Levering, Mich., March 3rd, 1904. Educ.: Univ. of Alta., 1925-30, (due to financial difficulties forced to leave univ. without degree); 1928-29-31, (summers), asst., rodman, Dominion Geological Surveys,Alberta Dept. of Highways; 1930-31, asst. geologist, instru'-man., H. B. Oil & Gas Co.; 1937-45, with Prairie Farm Rehabilitation, as follows: surveying dams for water development, complete charge and responsibility for all engrg. work on small projects in North Atla. Dist., and at present hydraulic engr., P.F.R.A., Calgary, Alta.

References: J. G. MacGregor, T. D. Stanley, B. Russell,'F. R. Burfield, C. M. Moore, G. L. MacKenzie, J. S. Neil.

LASSMAN—SALOMON H., of 382 Querbes Ave., Outremont, Que. Born at Chemnitz, Germany, March 3rd, 1923. (Polish nationality) Educ.: B.Sc., (Elect.) Univ. of New Brunswick, 1945; (admitted toMcGill Univ. for studies leading to M.Sc.); 1943, (summer), Bepco Ltd., Montreal; 1944, (summer), Taylor Electric Co., London, Ont., and at present lay-out dftsman. for amphibious vehicles, Dept. of Munitions & Supply, (Army Engrg. Design Branch).

References: A. M. Bain, A. F. Baird, E. O. Turner, J. H. Moore, B. A. Margo.

LEIGH—ERNEST DOUGLAS, Elect. Sub./Lt., R.C.N.V.R., of Montreal, Que. Born at Montreal, Nov. 10th, 1919. Educ.: Grad. special elect. course at 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); 1939-40, metall. lab. tech., Dominion amm. divn., Canadian Industries Ltd., Brownsburg, Que.; 1940, (11 mos.), elect. & mech. dftsman., sales divn., General Steel Wares, Ltd., Montreal; 1940 to date, with R.C.N.V.R., as follows: Supervisor of Instalns., elect. equipt. on R.N. Ships, and at present Elect. Instructor, H.M.S. Torpedo School, H.M.C.S. Stadacona, Halifax, N.S.

References: F. H. Sexton, G. H. Burchill, J. Deane, J. J. Smith, A. M. Swan, R. Wilcox.

LIVINGSTONE—JAMES GEORGE, of Sarnia, Ont. Born at Toronto, Ont., June 8th, 1920. Educ.: B.A.Sc., Univ. of Toronto, 1942; R.P.E., Ontario; with Imperial Oil Ltd., as follows: 1942-43, asst. chemist, control lab., 1943 to date, process engr., Sarnia, Ont.

References: G. L. Macpherson, C. P. Warkentin, F. F. Dyer, R. Neave, M. L. Walker.

LUNDIE—WILLIAM EARL, of Clarkson, Ont. Born at Kerrobert, Sask., Sept. 26th, 1912. Educ.: B. Eng. (Civil), Univ. of Saskatchewan, 1933; 1929, chainman, survey party, C.P.R.; 1930, student, topo. survey, Dept. Lands & Mines; with British American Oil, as follows: 1934, field engr., constrn. oil refinery, Moose Jaw, Sask., 1934-42, operator & plant engr., Moose Jaw, 1942-43, plant engr., Montreal East, Que., 1943-44, asst. refinery mgr., Toronto, Ont., and at present mech. supt., Clarkson, Ont.

References: F. A. Gaby, C. J. Mackenzie, A. R. Greig, R. A. Spencer, W. E. Lowell.

MARTIN—GERALD ALBERT BRAY, of Winnipeg, Man. Born at Winnipeg, Nov. 3rd, 1913. Educ.: B.Sc., (Elect.), Univ. of Manitoba, 1938; 1938-45, with Victor X-Ray Corp. of Can., Ltd., Winnipeg, and at present i/c engrg. service dept., Medical Arts Bldg., Winnipeg, Man.

References: G. R. Pritchard, E. P. Fetherstonhaugh, R. W. Moffat.

McDIARMAID—ROBERT BATSON, of Edmonton, Alta. Born at Edmonton, Alta., Jan. 18th, 1920, Educ.: B.Sc., (Elect.), Univ. of Alta., 1944; 1941-42 (summers), dftsman, Fort St. John Airport; with Dept. of Transport, as follows: 1943, (summer), electrical section, Edmonton District, 1944 to present res. elect. engr., elect. section, air services br., civil aviation divn., responsible for elect. instlns. at airports in Alberta, northern B.C. and the Yukon.

References: H. P. Keith, R. S. L. Wilson, J. W. Porteus, H. J. Williamson.

McGRECHY—ROBERT ANDREW, of Sarnia, Ont. Born at Collingwood, Ont., Oct. 11th, 1898. Educ.: B.Sc., C.E., Univ. of Michigan, 1923, (accredited E.C.P.D.); 1923-25, constrn. engrg., building, O. F. Miller Co.; 1925-27, Nickel Plate R.R.; 1927-30, railroads & bldgs., F. R. Jones Co.; 1930-40, engr. Imperial Oil Ltd.; 1940-45, R.C.E.; and at present, engr. in mechanical dept. on mtce., repair, and new constrn. of refinery equipt. & structures, Imperial Oil Limited, Sarnia, Ont.

References: F. F. Dyer, G. L. Macpherson, C. P. Warkentin, J. W. MacDonald, M. L. Walker.

McNELLIS—RALPH STEWART, of 179 Eglinton Ave., Toronto, Ont. Born at Toronto, Ont., Feb. 21st, 1899. Educ.: B.A.Sc., (Mech.), Univ. of Toronto, 1945; 1934-40, (summers), tool & diemaking & spec. machines; 1940-41, (7 mos.), i/c operations planning, Otis-Fensom Co., Ltd., Hamilton, Ont. (Bofors Gun); 1941-42, (7 mos.), i/c operations planning, Research Enterprises Ltd., Toronto; at present project & contract engr., John Inglis Co., Ltd., Toronto.

References: C. F. Morrison, W. S. Wilson, R. F. Legget, S. H. DeJong, R. T. Waines.

McRAE—WILLIAM ROBERTSON, Calgary, Alta. Born at Calgary, Alta., Oct. 14th, 1917. Educ.: B.Sc., (Chem. Eng.), Washington State Coll., 1943, (accredited E.C.P.D.); 1943-44, sr. pet. engr., Standard Oil Co. of California; 1944, pet. engr., General Petroleums; 1944, (part of yr.), pet. egr., Denton & Spencer, consultg. engrs.; 1944-45, Fuel Officer, Canadian Navy, with the rank of Lieut., Special Branch Engr.; and at present, managing-dir., Western Clay & Chemical Supply Co., Ltd., Calgary, Alta.

References: J. S. Irwin, J. F. Langston, F. K. Beach, O. P. Goodall, R. G. Laird.

MOON, CLIFFORD LESLIE, of Ottawa, Ont. Born at Wiarton, Ont., April 3rd, 1911. Educ.: B.A.Sc., Univ. of Toronto, 1934; 1934-36, shop work & genl. foreman, assembly depts., Beatty Bros., Ltd., Fergus, Ont.; 1937, dftsman., Backstay Standard Ltd., Windsor, Ont.; 1937-39, aircraft stress analyst and asst. i/c of static tests. Blackburn Aircraft Ltd., Yorks, England; 1939-41, jr. aero, engr., checking design of aircraft and components for conformity with airworthiness requirements, Dept. of Transport, Civil Aeronautics Divn., Ottawa; 1941-42, Sr. Asst. Engr. i/c Technical Intelligence, Dept. National Defence for Air; 1942-45, i/c engrg. dept., Cockshutt Moulded Aircraft Ltd.; and at present, forest products engr., Forest Products Laboratories of Canada, Ottawa.

References: T. A. McElhanney, W. E. Wakefield, J. H. Harkom, J. L. Smith, W. L. Shelden.

PHELPS—CHARLES STEWART, of 212 Ross Ave., Sarnia, Ont. Born at Sarnia, Ont., Aug. 2nd, 1910. Educ.: B.A.Sc., (Eng.), Univ. of Toronto, 1934; R.P.E., Ontario; with Canadian Genl. Elect. Co., as follows: 1934-1935, students' test course, 1935-36, appliance & merch. dept., domestic refrigeration, 1936-37, head office asst., commercial & ind. refrigeration, 1937-41, section mgr., i/c activities on low pressure refrigeration equipt., 1941-42, head office asst., when air-cond. divn. disbanded transferred to wire & cable section; 1942-43, material expediter on constrn., working in engrg. dept., on Polymer project at Sarnia, Canadian Kellogg Co., Ltd.; with St. Clair Processing Corp., Ltd., Sarnia, as follows: 1943-45, asst. elect. engr., power house, and from May to date, elect. engr., i/c operation & mtce., power house.

References: C. F. Davison, E. W. Dill, R. W. Dunlop, J. Belleny, T. Montgomery.

PIRNIE—MALCOLM, of 15 Woodland Place, Scarsdale, N.Y. Born at New York, N.Y., Feb. 6th, 1889. Educ.: S.B., M.C.E., Harvard University, 1910 and 1911; D. Eng., Rensselaer Polytechnic Inst.; with Hazen & Whipple & Fuller, New York, as follows: 1911-16, asst. engr., 1916-29, member of firm, Hazen, Everett & Pirnie; 1929 to date, own company, Malcolm Pirnie, civil engr., consultg. services to Federal, State, County and Municipal Governments, industries, water companies and individuals.

References: J. B. Challies, A. Surveyer, C. R. Young, L. A. Wright, J. M. R. Fairbairn, K. M. Cameron, deG. Beaubien.

POLLARD—ROY, of Box 330, Nelson, B.C. Born at Bacup, Lancs, Eng., April 11th, 1892. Educ.: Accrington Tech., (England), 1906-12, and private tuition; articled to architect & surveyor, passed Surveyors' Inst. exams., 1915; R.P.E., British Columbia; 1926-45, asst. dist. engr., Water Right Branch, Dept. of Lands, Prov. of B.C., and at present water rights engr., (dist. engr.) Dept. of Lands & Forests, Nelson, B.C.

References: J. P. Coates, A. D. Creer, E. Davis, J. C. MacDonald, E. Smith, C. E. Webb, H. R. Younger, W. Ramsay.

RAYMOND—JEAN MAURICE of Montreal, Que. Born at Montreal, Dec. 2nd, 1909. Educ.: S.B., (Chem), Mass. Inst. Tech., 1934; 1935-37, surveying, structl. & elect. work for Dr. F. Gaby, consultg. engr.; 1937 to date, vice-pres., Raymond Hardware Ltd., and at present, president, manufacturing aluminum ware.

References: F. A. Gaby, G. O. Vogan, E. G. Carmel, L. A. Duchastel, L. Trudel.

READ—WALLACE FOSTER, Lieut., R.C.E., of Fort William, Ont. Born at Fort William, Oct. 4th, 1921. Educ.: B.Sc., (Chem. Engrg.), Queen's Univ., 1942; R.P.E., Ontario; 1939-40-41-42, (summers), testing and control work, Great Lakes Paper Co.; 1943 to date, with R.C.E., as Lieutenant, C.E.T.C., Petawawa, Ont.

References: D. S. Ellis, R. A. Low, S. D. Lash, S. T. McCavour.

RICHER—JEAN HERBERT, Lieut. (E), R.C.N.V.R. of 708 Victoria Ave., Westmount, Que. Born at Montreal, Que., March 24th, 1918. Educ.: B. Eng., (Mech.), McGill Univ., 1943; 1941, (summer), radio tech., CBO Station, Ottawa; 1942, (summer), genl. machine shop work, Howard Smith Paper Mills, Beauharnois, Que.; with R.C.N.V.R., as follows: 1943-45, Engr. Officer, and at present Asst. Staff Officer Appointments & Records for Engineer Officers.

References: A. R. Roberts, E. Gohier, C. M. McKergow, J. A. Coote, L. A. Duchastel.

RING—ROY PERCIVAL, Lieut. (E), R.C.N.V.R., of Hamilton, Ont. Born at Saint John, N.B., Jan. 13th, 1911. Educ.: B. Eng., (Mech.), Nova Scotia Tech. Coll., 1940; R.P.E., Ontario; 1930-33, machinist apprent., turning, fitting, sheet metal, etc.; with Canadian Westinghouse Co., Hamilton, Ont., as follows:

1940-42, engr. apprent., service dept., corr., dept., tool (designing, etc.,1942, (7 mos.), engr. i/c torpedo engine testing, 1942-43 (6 mos.), acting supt. air brake dept., mfg. freight brakes, engine & tender equipt., etc., torpedo engines; 1943 to date with R.C.N.V.R., and at present Engr. Officer of Fuel Comb. Dept., c/o F.M.O., Halifax, N.S.

References: H. W. McKeil, F. H. Sexton, H. A. Ripley, J. S. Fowler, H. O. Peeling, M. L. Baker.

ROSE—HAROLD THOMAS, of 2121 Lundy's Lane, Niagara Falls, Ont. Born at St. John's, N'fld., July 22nd, 1919. Educ.: B.Sc., St. Mary's College, Halifax, 1940; B. Eng., Nova Scotia Tech. Coll., 1942; 1938-39, (summers), base line & observing parties, recorder, Geodetic Survey of Canada; 1940, (summer), instr'man.; 1941, (summer), chief of survey party, U.S. Engr. Dept., Military Bases & Roads; 1942 to date, with H. G. Acres & Co., Niagara Falls, Ont., on hydraulic computation; Shipshaw, Steep Rock Iron Mines, Polymer Corp. Ltd., and at present designing dftsman., structl. design & detail.

References: H. E. Barnett, A. W. F. McQueen, J. H. Ings, F. H. Sexton, C. F. Morrison.

RUDNICKI—JOSEPH M., of 432 Nelson St., Ottawa, Ont. Born at Malecz, Poland, Feb. 6th, 1909. Educ.: Mech. Engr., Ecole Tech. d'Aeronautique, Paris, France, 1932; 1932-33, (8 mos.), jr. tool designer, Henriot Airplane plant, Argenteuil, nr. Paris; 1933, (2 mos.), tool designer, Couzinet Airplane plant, Paris; 1933-34, (1½ yr.), shop supt., fire extinguishers & auto. accessories, Paris, 1936-39, first planning engr., P.Z.L., gov. planes works, Warsaw, Poland; 1939-40, tool designer & research engr., Societe Nationale de Construction Aeronautique du Sud-Est, Paris; 1941-43, tool designer, Ottawa Car & Aircraft, Ltd., Ottawa, Ont.; at present, design dftsman, Alex. Fleck Ltd., Ottawa, Ont.

References: H. D. Hyman, D. Goldwag, W. Czerwinski, J. S. Korwin-Gosiewski, J. Pawlikowski.

RUSSELL—ANDREW, Cmdr. (E), R.C.N.R., of Toronto, Ont. Born at Carlisle, England, March 19th, 1898. Educ.: Rutherford Tech. Coll., Newcastle-on-Tyne, England, 1915-17; Member, A.S.M.E.; engrg. ap'ticeship., as follows: 1913-17, Swan, Hunter & Wigham Richardson, Newcastle-on-Tyne, 1917-18, Barclay Curle & Co., Glasgow; 1918-28, Engr. Officer, Naval & Merchant Vessels i/c boilers & machinery; with Imperial Oil Ltd., as follows: 1928-30, drawing office, design of pressure vessels & pumphouses, etc., Sarnia, Ont., 1930-41, inspecn. & mtce. of high pressure, high temperature refining equipt. in six Canadian refineries, Sarnia; 1942 to date, with R.C.N.R., and at present Chief Engr., H.M.C. Dockyard, Halifax, N.S.

References: T. Montgomery, W. H. G. Rogers, C. Scrymgoeur, L. E. Mitchell, G. R. McMillin, C. E. Carson.

SCHMIDT—DONALD VICTOR, 207½ N. Front St., Sarnia, Ont. Born at Toronto, Ont. on June 12th, 1918. Educ.: B.A.Sc., (Chem.), Univ. of Toronto. 1944; R.P.E., Ontario; 1940, (summer), genl. plant work at Canada Car & Foundry, Fort William; 1943, (summer), jr. engr., drafting & designing, Universal carriers, Ford Motor Co. of Can., Windsor, Ont.; with Victory Aircraft, as follows: 1944, (5 mos.), metallurgist, Malton, Ont., 1944-45, (6 mos.), transferred to aero engrg. dept., put through drawing alterations & engrg. orders for repair schemes and necessary changes on Lancaster bombers & T.C.A. transports, handled complaints & troubles in shop and made adjustments, worked in close co-ordination with R.C.A.F.; at present, inspection chemist, Imperial Oil Limited, Sarnia, Ont.

References: G. L. Macpherson, C. P. Warkentin, E. G. MacGill.

SCOTT—ARTHUR BENJAMIN, of 122 Hellems St., Welland, Ont. Born at Welland, Ont., March 1st, 1914. Educ.: B. Arch., Univ. of Toronto, 1939; 1934-1939, (summers), erection of ind. furnaces, architectural dftsman.; 1939-41, arch. partnership with R. I. MacBeth; 1940-41, plant engr., United Steel Corp.; 1941-42, supt. ind. furnace instalns., Atlas Steels, for G. C. Scott & Sons; and at present resuming practice in architecture & structl. design, and consultant in, ind. furnace constrn., on retirement from Armed Forces, Oct. 9th, 1945.

References: J. C. Street, W. D. Brownlee, H. V. Wildwood.

SMITH—OSBORNE KINGDON, Works Officer, R.C.E., of Toronto, Ont. Born at Toronto, Oct. 28th, 1917. Educ. B.A.Sc., Univ. of Toronto, 1942; R.P.E., Ontario; 1938, (summer), timekeeper, road constrn., G. S. Grant Constrn. Co.; 1939, (summer), survey camp, Univ. of Toronto; 1940, (summer), track layout & mtce., helper, C.N.R., Toronto divn., 1940, (2 mos.), topographer, road location survey, C. E. Bush; field engr., plant constrn., layout of roads, General Engrg. Co., Ltd.; with Preload Co. of Can., Ltd., as follows: 1942-43, res. engr., constrn. prestressed concrete tanks at Arvida, Shawinigan Falls and Beauharnois, office mgr., at latter two stations, 1943, (3 mos.), research & design prestressed concrete beams; 1943 to present, C.E.T.C., Petawawa, and at present Works Officer, M.D. No. 1, London, Ont.

References: C. R. Young, R. F. Legget, C. F. Morrison, E. P. Muntz, W. M. Veitch, R. W. Garrett, W. S. Wilson.

STRACHAN—DAVID COPLAND, of 4 Crown Street, Port Arthur, Ont. Born at Montrose, Scotland, Nov. 6th, 1907. Educ.: B.A.Sc., Univ. of Toronto, 1933; 1934, (4 mos.), elect. layout design, Hollinger Gold Mines, Timmins, Ont.; with Young-Davidson Mine, as follows: 1934-35, (7 mos.), foreman, instaln. elect. equipt. during constrn. of mill, 1935-42, elect. supt., Matachewan, Ont.; 1942-44, supt. on instalns. elect. equipt. for Demerara Bauxite Co., Ltd., Mackenzie, British Guiana, S.A.; 1945, to date, elect. layout design for grain elevators, for C. D. Howe, Co., Ltd., Port Arthur, Ont.

References: J. M. Fleming, W. C. Byers.

THOMPSON—HOWARD BELL, of Sarnia, Ont. Born at Picton, Ont., Jan. 8th, 1886. Educ.: B.A.Sc., Univ. of Toronto, 1915; R.P.E., Ontario; 1910-14, Dominion Bridge Co., Lachine, Que.; 1915-16, Ontario Dept. of Highways; 1916 to date, with Imperial Oil Ltd., engrg. dept., chief dftsman, design engr., specifying & pur. of elect. equipt., and at present, mech. & elect. engr. and asst. engr. to chief, Sarnia, Ont.

References: G. L. Macpherson, T. Montgomery, C. P. Warkentin, F. F. Dyer, G. W. Christie, J. W. MacDonald.

TIEDJE—JOHN LOUIS, of Sarnia, Ont. Born at Princeton, B.C., April 18th, 1921. Educ.: B.A.Sc., M.A.Sc., Univ. of British Columbia, 1944 & 1945; R.P.E., B.C.; 1940, (summer), helper, foundry, Trail, B.C.; 1941, (summer), helper, machine shop, Trail; 1942-43, (summers), with Cons. Mining & Smelting Co., Trail, as assayer and tester, sulphuric acid plant; 1944, (summer), chemist, Pacific Lime Co., Blubber Bay, B.C.; research on Alberta tar sands, Univ. of Alberta; and at present, chem. engr., technical & research dept., Imperial Oil Ltd., Sarnia, Ont.

References: R. W. Diamond, E. M. Stiles, S. C. Montgomery, C. E. Marlatt, A. C. Ridgers, F. F. Dyer.

WALSH—FREDERICK FRANCIS, of Sarnia, Ont. Born at Toronto, Ont., Aug. 21st, 1916. Educ.: B.A.Sc., (Mech.), Univ. of Toronto 1940; R.P.E., Ontario; 1936-37-38-39-40-41 ,(summers), with Link Belt Co., Ltd., Toronto, Macassa Mines Ltd., Kirkland Lake, Ont., British-American Oil Co., Toronto, Canada Carbon & Ribbon Co., Toronto, The Steel Co. of Canada, Hamilton, Ont.; 1941-43, The Steel Co. of Canada, Hamilton; 1943-45, The St. Clair Processing Corp. Ltd., Sarnia, and at present, tech. supervisor, steam & power plant.

References: E. W. Dill, B. H. Sherwood, C. P. Warkentin, G. L. Macpherson, E. K. Lewis, T. Montgomery, A. H. Munro.

WOODS—JOHN PARKER, Lieut. (E), R.C.N.V.R., of Montreal, Que. Born at Halifax, N.S., June 11th, 1920. Educ.: B. Eng., (Mech.), Nova Scotia Tech. Coll., 1942; 1940-41, (summers), with Imperial Oil Ltd., as follows: machinist & mechanical engr. on M/S Torontolite; 1942 to date, with R.C.N.V.R.

References: J. P. Messervey, J. W. March, H. A. Ripley, E. C. Thomas, R. L. Dunsmore.

FOR TRANSFER FROM JUNIOR

GOROWSKI—CHARLES STANLEY, of 17 Indian Road Crescent, Toronto, Ont. Born at Winnipeg, Man., Feb. 26th, 1913. Educ.: B. Eng., (Elect.), Univ. of Man., 1934; 1940, (7 mos.), civil engr., Du-Rite Co. of Can., i/c group or 8 to 10 men; 1940-42, (2 mos.), tech. engr., Canadian Ass. Aircraft Ltd.; 1942 to date, with DeHavilland Aircraft, Toronto, as follows: tech. engr. i/c staff 16 people, and at present asst. mgr., sub-contract dept. (Jr. 1941).

References: E. P. Fetherstonhaugh, W. E. Seely, W. Czerwinski, G. H. Herriot, N. M. Hall, O. R. Brumell.

HUNT—WILLIAM SINCLAIR, Major, R.C.E.M.E., of Montreal, Que. Born at Summerside, P.E.I., Dec. 8th, 1912. Educ.: B.Sc., Acadia Univ., 1934; B. Eng., (Chem.), McGill Univ., 1936; 1935, (4 mos.), asst. chemist, Champlain Oil Co., Montreal; 1936-40, with Dominion Rubber Co., Montreal, industrial engrg. dept.; 1940 to date, on Active Service, and at present awaiting posting or discharge. (Jr. 1940).

References: H. G. Conn, J. B. Phillips.

SHAPCOTTE—REGINALD, of Jumbo Gardens P.O., Port Arthur, Ont. Born at Port Arthur, Ont., Feb. 26th, 1913. Educ.: Diploma, Ass. Member. British Institute of Engrg. Technology, London, Eng.; 1937-39, L. Y. McIntosh, Arch.; 1939-40, Public Works of Canada; 1940, C. D. Howe, Co., Port Arthur, Ont.; 1940-41, under chief engr., Pacific Mills, Ocean Falls, B.C.; 1941-44, R.C.E., Works Officer, discharged May, 1945; and at present reconstrn. engr., planning, estimating post-war projects, structl. design of all types, Public Works of Canada, Fort William, Ont. (Jr. 1940).

References: W. O. Marble, H. M. Lewis, P. E. Doncaster, W. G. Swan, H. B. Stuart, J. M. Fleming, H.Os, G. H. Burbidge.

FOR TRANSFER FROM STUDENT

AUGER—ROLAND ALBERT, of 3555 Cote Ste. Catherine Rd., Montreal, Que. Born at Winnipeg, Man., March 24th, 1918. Educ.: B.A.Sc., C.E., Ecole Poly., 1943; 1943 to date, with Shell Oil Co. of Can., as follows: asst. to mtce. & utilities engrs., i/c of work as asst. to mtce. & utilities engrs., and at present mech. engr., Montreal East, Que. (St. 1941).

References: J. S. Ball, S. Mitcheson, R. O. Stewart, A. Circe, J. A. Lalonde.

BERG—ARNOLD JENS, of Dawson Creek, B.C. Born at Claresholm, Alta., Jan. 18th, 1918. Educ.: Univ. of Alta., 1937-38; 1938-41, gravel checker, rodman, levelman, sr. asphalt inspectr.; 1941 to date, with Dept. of Transport, Dominion Gov., as follows: 1941-42, asst. to res. engr., airport constrn., 1944-45, i/c instln. water & sewerage, sewage disposal plant, Dawson Creek, B.C., and at present, resident engr., Department of Transport, Dawson Creek, B.C. (St. 1944).

References: H. P. Keith, A. L. H. Somerville, A. Frame, E. Skarin, T. Miard.

HILLER—WALTER ANDREW, of Edmonton, Alta. Born at Sedgewick, Alta., Feb. 27th, 1915. Educ.: B.Sc., C.E., Univ. of Alta., 1943; 1942-43, (summers), instr'man., lab. technician, Dept. of Transport; 1943 to date, Officer I/C Special Engrg. Equipt., Petawawa Military Camp, and at present Reinforcement Officer, Edmonton, Alta. (St. 1943).

References: I. F. Morrison, L. Thorrsen, R. Hardy, A. L. H. Sommerville, W. J. Murray.

KIRKWOOD—JOHN GORDON, of Walkerville, Ont. Born at Saskatoon, Sask., Oct. 25th, 1918. Educ.: B.Sc., (Civil Engrg.), 1942, Detroit Inst. Technology, (accredited E.C.P.D.); with Canadian Bridge Co., Walkerville, as follows: 1936-41, (summers), field constrn., drafting room, 1942-43, dfting. room, 1943-44, engrg. dept., and at present in welding design. engrg. dept. (St. 1939).

References: P. E. Adams, A. H. MacQuarrie, W. R. Mitchell, W. R. Stickney, J. B. Dowler.

KOROPATNICK—PETER, Lieut., R.C.E., (overseas). Born at Varcoe, Man., Sept. 21st, 1918. Educ.: B.Sc., (Civil), Univ. of Manitoba, 1941; 1938-39, (summers), land surveying, dfting., rodman, instr'man., F. C. Lane, O.L.S., Sudbury, Ont.; 1940, (summer), office engr., drawings, layout, inspectn., 1941, (7 mos.), res. engr., Good Roads Board, Manitoba; 1942 to date, with R.C.E., and at present in 3rd Cdn. Repat. Depot, C.A.O. (St. 1940).

References: E. P. Fetherstonhaugh, G. H. Herriot.

MacLEOD—FREDERICK JAMES GORDON, Constr. Lieut., R.C.N.V.R., of Outremont, Que. Born at Montreal, March 9th, 1922. Educ.: B. Eng., (Civil), McGill Univ., 1944; 1940, (summer), mucker, Asbestos Corp., Thetford Mines; 1941, (summer), head checker, Dept. of Transport, Dorval Airport; 1942, (summer), surveyor, C. C. Lindsay & Co.; 1943 to date, N.S.H.Q., Ottawa, Ont. (St. 1944).

References: R. DeL. French, G. J. Dodd, J. J. O'Neill, F. Keith, C. C. Lindsay.

MASON—VERE KARSDALE, Lieut. (E), R.C.N.V.R., of Esquimalt, B.C. Born at Paradise, N.S., Dec. 9th, 1916. Educ.: B. Eng., (Civil), McGill Univ., 1942; with Shawinigan Engrg. Co., Ltd., Montreal, as follows: 1939-40, (4 mos.), concrete detail & design, elect. equipt. layout for La Tuque Power Development, 1941, (summer), Quebec Power efficiency tests on model water turbines at hydraulic experimental plant; 1942-43, (9 mos.), reinforced concrete designer, latest methods of continuous design, Aluminum Co. of Can., Ltd., Montreal; 1943 to date, with R.C.N.V.R., and at present Shop Planning & Base equipt. Officer, H. M. C. Dockyard. Esquimalt, B.C. (St. 1942).

References: R. E. Heartz, J. A. McCrory, S. R. Banks, W. L. Pugh, D. G. Elliot, H. F. Kent, H. W. McKiel, E. Brown, R. deL. French, R. E. Jamieson.

PINK—JOHN FREDERICK, Lieut. (Elect.), R.C.N.V.R., of Winnipeg, Man. Born at Transcona, Man., Jan. 20th, 1920. Educ.: B.Sc. (Elect.), Univ. of Manitoba, 1942; R.P.E., Man.; 1940, (summer), engrg. apprentice; 1941, (summer), dfting. & design, Canadian Westinghouse Co.; 1943-45, R.C.N.V.R.; 1945, (Nov. 1st), to accept engrg. design & dfting. position with E. I. Du Pont de Nemours Co., Wilmington, Del. (St. 1945).

References: E. P. Fetherstonhaugh, N. M. Hall, E. V. Caton, E. G. Cullwick.

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

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

CIVIL ENGINEER, bilingual, ex-service man is wanted to act as instrumentman 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, graduate, age 30 or under with four or five years' experience is required to act as field engineer for a large company in Montreal. The work would involve surveys and layouts for pulp and paper mill extensions in northern Quebec. Apply to Box. No. 3131-V.

CIVIL ENGINEER, age 27-35, with experience is 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, age 35-45 with good experience is required to act as design engineer in charge of work in connection with dams, buildings, material handling equipment, etc., by a company in Montreal. Salary would be between $300. and $350. depending on experience. Apply to Box No. 3144-V.

CIVIL ENGINEER with experience in surveying, on either highway or railway work, is required to locate about 15 miles of railway in northern Ontario. Salary would be from $350. according to qualifications. Apply to Box No. 3148-V.

CIVIL ENGINEER, preferably with some experience, age between 25 and 40 is required to act as structural designer on structural steel and reinforced concrete for a firm of contractors and builders in Montreal. Apply to Box No. 3149-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 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. Apply to Box No. 3161-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, with a few years experience, age 28-30 is required by a mining company in Quebec for general work including layout and draughting. Apply to Box No. 3136-V.

ELECTRICAL ENGINEER, graduate, with four or five years pulp and paper experience and preferably returned service man, under 40 years of age, is required by a paper company in the province of Quebec. Salary would be about $400. a month. Apply to Box No. 3153-V.

MECHANICAL

MECHANICAL ENGINEER, graduate, age about 30, with two or three years draughting and design experience and overseas military service preferably in RCEME, with actual experience in a workshop on tanks, tractors, etc., is required to act as assistant to the chief engineer of a company engaged in the manufacture of newsprint with several mills in the province of Quebec. Candidates must be bilingual, tactful and resourceful. The work will involve investigation of maintenance problems, study of new wood-handling methods and a variety of engineering projects in the various mills. Salary will be $300.-$350 a month. Apply to Box No. 3024-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.

STEAM POWER PLANT ENGINEER, age 35-45 with some experience in this field is required by a company in Montreal. Salary would be from $300. to $350. a month depending on experience. Apply to Box No. 3144-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, graduate, with four or five years pulp and paper experience and preferably returned service man, under 40 years of age, is required by a paper company in the province of Quebec. Salary would be about $400. a month. Apply to Box No. 3153-V.

MECHANICAL ENGINEER, bilingual, age 25-35 is required to act as plant engineer for a company engaged in the manufacture of brick and tile in the province of Quebec. Preference will be given to returned service man and salary would be about $200. a month. Apply to Box No. 3156-V.

MECHANICAL DRAUGHTSMAN, not necessarily a graduate but with some experience, is required by a company in Montreal for work on plant layouts and installations. Salary would be $175. to $225. a month depending on experience. Apply to Box No. 3157-V.

MECHANICAL OR CIVIL GRADUATE with two or three years' experience, age 25 to 35, preferably discharged service man is required to act as assistant engineer on plant layout work including machinery, rotary kilns, etc., by a company in Montreal. Position might eventually lead to sales work. Salary $200. to $250. depending on experience. Apply to Box No. 3158-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.

MISCELLANEOUS

YOUNG GRADUATE ENGINEER (Mechanical preferably) with some experience in production and manufacturing problems is required for a Montreal manufacturing company. Permanent position with good prospects for advancement. Preference will be given to discharged service man. Apply to Box No. 3160-V.

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.

FORESTRY ENGINEER, graduate, 25-35 years old, preferably bilingual, returned service man is required by a newsprint manufacturer in the St. Maurice Valley. Apply to Box No. 3142-V.

ARCHITECTURAL DRAUGHTSMAN, not necessarily a graduate engineer, with four or five years' experience is required for temporary work with a large company in Montreal. Salary would be about $275. a month. Apply to Box No. 3143-V.

PUBLICITY MAN capable of looking after catalogues, photographs, advertising, and editing of a journal, with some technical knowledge and ability to write interesting articles on electrical installations, is required by a company in Montreal. Apply to Box No. 3151-V.

PLANT ENGINEER is required by a sulphite company in the province of Quebec, to be responsible for all mechanical and electrical maintenance and construction in mill and in connection with town lighting system. Successful applicant would act as consulting engineer for town and woods department. Candidates must have good experience and preference will be given to returned service man. Salary about $450. a month. Apply to Box No. 3152-V.

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

CHEMICAL

PAPER MILL FOREMAN is required by a paper company in the St. Maurice Valley to learn paper-making. Preference will be given to an ex-service man and salary will be from $225 to $300 a month. Apply to Box No. 3022-V.

CHEMICAL ENGINEER is required to act as junior chemist in a pulp and paper mill in the province of Quebec. Salary would be $175. to $200. a month depending on experience. Apply to Box No. 3116-V.

CIVIL

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.

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.

TOWN MANAGER is required by a town in northern Quebec. Candidates should be bilingual, graduate engineers with considerable surveying experience. Apply to Box No. 3099-V.

PLANT MANAGER is required by a company specializing in road building materials, construction materials, etc., position will involve management and organization of a company which is being reorganized in the Eastern Townships. Preference will be given to candidates who are graduate engineers, bilingual and returned service men. Apply to Box No. 3105-V.

CONSTRUCTION SUPERINTENDENT, age 35-45, familiar with construction and contracting and capable of handling men, is required by a firm of contractors in Ontario. Salary would be about $300. a month. Apply to Box No. 3125-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.

SEVERAL ELECTRICAL ENGINEERS with some knowledge of civil engineering are required for public utility work in the Montreal area. Candidates should be recent graduates, bilingual and could expect a salary of about $200. a month. Apply to Box No. 3108-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, preferably with some experience in the pulp and paper industry is required for draughting and design work with a pulp and paper company in the Lake St. John district at a salary of approximately $300. a month. Apply to Box No. 2941-V.

MECHANICAL ENGINEER with three or four years' general experience and about 25 years old, is required for general investigational work, methods improvement, etc., in a large new factory in the Montreal area. Salary will be about $225. a month. Apply to Box No. 3049-V.

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 required as assistant engineer in meat packing firm with plants throughout Canada. Duties to consist of design and layout of steam, refrigeration, and processing equipment, and cost control work in steam and refrigeration production. Position available in Calgary at a salary of $195 to $240 per month depending on experience. Apply to Box No. 3082-V.

TWO MECHANICAL ENGINEERS are required as mechanical superintendents with leading meat packing plant. Duties consist of supervising the operation of steam, refrigeration and electrical equipment, and the maintenance of all buildings and equipment. Positions available at Vancouver and Regina. Would prefer men with experience on similar work, under 40 years of age. Salary $220 to $280 a month depending on experience. Apply to Box No. 3083-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

TWO MECHANICAL ENGINEERS with experience in plant layout and design are required by a chemical manufacturing company at Shawinigan Falls, Que. Salary $250. and upwards depending on experience. Apply to Box No. 3079-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.

METALLURGICAL

METALLURGICAL 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.

METALLURGICAL ENGINEER is required by an aircraft company in the Montreal area. Apply to Box No. 3113-V.

MISCELLANEOUS

RECENT GRADUATE in engineering is required to act as technical assistant for a firm of patent attorneys engaged in important industrial work in the Montreal area. Apply to Box No. 3061-V.

FIELD SERVICE ENGINEER, qualified to give instruction in shops or clinics on automotive electrical systems, carburetion systems and fuel systems for the service department of a firm interested in covering the province of Quebec and the Maritime provinces. Should be fluently bilingual. Apply to Box No. 3077-V.

TWO CIVIL OR MECHANICAL GRADUATES, preferably with some experience in plant layout work are required by a firm in eastern Quebec. Work would involve draughting at first with complete control of a process after some months. Candidates should be 25-35 years old and salary would be about $200 a month. Apply to Box No. 3079-V.

SEVERAL SALES ENGINEERS not necessarily graduates but with mechanical inclinations and good appearance, between the ages of 21 and 25, are required to be trained in Montreal by a firm engaged in the production of machine tools and machinery. Preference will be given to returned service men and salary would be from $150 a month up, depending on experience. Apply to Box No. 3085-V.

AERONAUTICAL ENGINEER with some experience, about 30 years old, required for stress analysis work by a company in the Montreal area. Apply to Box No. 3096-V.

DRAUGHTSMAN is required for the preparation in their final form of geophysical, geological and survey plans. Candidates must be good at lettering and if possible have some knowledge of geology and surveying. This position would be with a consulting engineer in northern Quebec. Apply to Box No. 3098-V.

INSTRUMENT MAN familiar with electrical systems of aircraft, not necessarily a graduate engineer, is required in the Montreal area for work in connection with problems of faulty installations, etc. Salary would be $200. a month. Preference will be given to qualified discharged service man. Apply to Box No. 3120-V.

GRADUATE ENGINEER in electrical, mechanical, mining or metallurgy, English-speaking with a good command of French, is required by a firm of manufacturers of abrasives and refractories, to operate a quarry and a sand mill near Montreal. Apply to Box No. 3122-V.

SALES ENGINEER, not necessarily a graduate but with good engineering and shop experience, age 30-40 years, is required by a firm engaged in the manufacture of tools and dies in the Montreal area. Sales personality very important, starting salary would be about $50. a week. Apply to Box No. 3128-V.

ARCHITECT or graduate civil engineer, age about 25 is required in Montreal for draughting and design work in connection with new buildings for a large company. Salary would be $200. a month. Apply to Box No. 3133-V.

SALES ENGINEERS are required by a company in Montreal engaged in the manufacture of insulating materials. Candidates must have technical education and preferably some plant operating and sales experience. Conversational knowledge of French desirable. Salary would be $200-$225 a month plus commissions. Apply to Box No. 2993-V.

SEVERAL ENGINEERING DRAUGHTSMEN, preferably ex-service men, 30 years or younger, are required by a Canadian newsprint manufacturer. Salary would be between $160 and $250 a month depending on experience. Apply to Box No. 3023-V.

Situations Wanted

ELECTRICAL ENGINEER, M.E.I.C., age 38, married, B.Sc. McGill. Widespread experience on electrical mill maintenance, radio and telephone engineering. Five and a half years in the R.C.A.F. specializing on aircraft electrical work. Familiar with Harland and General Electric paper mill drives. At present expecting imminent discharge from the R.C.A.F. Interested in maintenance, development or layout design of electrical equipment. Apply to Box No. 12-W.

MECHANICAL ENGINEER, Canadian graduate, age 45, married with eighteen years experience in foundry, machine shop, structural fabrication and assembly work, seeks a responsible position in this field. Accustomed to handle executive responsibilities and with a proven ability to secure the co-operation of others. Apply to Box No. 251-W.

ELECTRICAL ENGINEER, B.Sc., McGill '31, currently holding responsible supervisory position in government war agency, available on short notice. Interested in inspection, plant engineering and management. Prefer remaining in Montreal area. Apply to Box No. 626-W.

ELECTRICAL ENGINEER, M.E.I.C., age 35, with thirteen years' experience in manufacturing electrical and mechanical products, including production supervision and management, designing, engineering, sales, purchasing, cost accounting, advertising and wage and labour problems. Available about January 1st, 1946. Apply to Box No. 816-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., R.P.E., Age 29, six years' experience including design, construction, field installation of hydraulic equipment, presses, pumps, valves, etc. Also F.H.P. refrigeration equipment. Available Dec. 1945 under W.B.T.P. regulations. Apply to Box No. 1595-W.

MECHANICAL ENGINEER, age 34, Lt. (E) R.C.N.V.R., soon to be discharged. Experience, 6 years heavy maintenance on railroads, 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 R.C.N.V.R. of which 20 months have been at sea. Thorough knowledge of machine and boiler shops, able to plan and to handle men. Registered with W.B.T.P. Apply to Box No. 2456-W.

MECHANICAL ENGINEER, M.E.I.C., R.P.E. (Que.) and B.Sc. McGill, married, 45 years old. Experienced in plant design, layout and construction. Seventeen years in construction, owning own business and five years in munitions manufacture. Experienced business manager and executive. Available now for responsible position. Apply to Box No. 2526-W.

GRADUATE MECHANICAL ENGINEER, S.E.I.C., R.P.E.(Ont.), graduate of Nova Scotia Technical College, 1943, age 25, married. Two years as Sub Lieut. and Lieut.(E) R.C.N.V.R., engineer draughtsman and estimator on complete naval fuelling base layouts, tankage, piping, pumping stations and wharf facilities. Also six months of heating and plumbing layouts for naval buildings. Honorably discharged, March, 1945. Presently employed as heating engineer with contracting firm installing heating and plumbing facilities in fifteen story hospital building. Desire permanent connection with opportunities for advancement. Available under W.B.T.P. regulations. Location immaterial if living accommodations available. Apply to Box No. 2532-W.

GRADUATE CIVIL ENGINEER, Jr.E.I.C., in B.C., 30 years of age, married, experience mostly mechanical; 5½ years oil refinery construction, maintenance, laboratory and processing, one year aircraft inspection. Past three years as assistant engineer with firm engaged in the manufacture of naval instruments, in charge of fine pitch gear manufacture and plastic molding. Apply to Box No. 2533-W.

CHEMICAL ENGINEER, age 28, single, desires position with responsibility and good future prospects. Applicant has one year's experience in research and development, 3 years in production and administration, and is a qualified instructor of job instruction training, job methods training, safety and job evaluation. At present engaged as area supervisor of production. Immediately available under W.B.T.P. regulations. Apply to Box No. 2534-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., age 28, with 5 years' experience in large plant operation, design and construction, and executive training and experience in safety engineering, desires position with industrial concern in construction, building supplies, plant operation or safety engineering. Applicant will be available October 1st, 1945, or thereafter. Apply to Box No. 2536-W

GRADUATE METALLURGICAL ENGINEER, age 25, available immediately. Canadian, bilingual, desires employment in Montreal or vicinity. Willing to travel occasionally. Experience in light metals and gray cast iron metallurgy, foundry practice. Has held responsible position in charge of production industrial engineering, buying, supervisory experience. Would consider employment with industrial consultants or with progressive engineering organizations or in sales. Apply to Box No. 2554-W.

MECHANICAL ENGINEER, graduate, 42, married, bilingual, 18 years' experience in foundry in charge of production. Familiar with plant layout, executive ability and experienced in handling men, desires to secure position with plant where ability could be recognized. Available immediately, location immaterial. Apply to Box No. 2555-W.

PARTNER WANTED, McGill graduate, B.Sc. '23 just returned from overseas service, having pre-war experience as part-owner of small metal-working shop, is considering setting up small mechanical and/or electrical manufacturing business in Montreal and wishes to meet one or two persons (preferably engineering graduates) who might be interested in active partnership, for purposes of preliminary discussions. Alternatively, advertiser would consider taking active interest in an existing business. Apply to Box No. 2559-W.

MECHANICAL ENGINEER, B.Eng. (McGill), S.E.I.C., age 25, single, bilingual; one year mechanical experience in paper mills, including machine shop and maintenance work. Presently serving overseas with R.C.E.M.E. Two years army experience in machine shop supervision and motor transport overhaul and maintenance. Not available till released from Army but wishes to make contacts for post-war position preferably in province of Quebec. Apply to Box No. 2561-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.

PLANT ENGINEER

Graduate with pulp and paper mill experience to supervise maintenance of kraft pulp mill. Familiar with preventative maintenance and skill in dealing with labour problems.

SENIOR ENGINEERS

Two graduates of mechanical or civil with pulp and paper mill experience to act as project engineers in engineering department of sulphate pulp mill. Candidates must have considerable ability to follow through projects from study and design to construction and operation. Salary according to experience and results.

Apply to Box No. 3093-V

Industrial Promotion Engineer

Graduate engineer, preferably between 35 and 45 years of age, required by large corporation, for the promotion of industrial power sales. Must have a basic knowledge of electricity, general experience in industry and a good business background. Knowledge of French essential. Creative imagination and ability to investigate industrial development are prime requisites. When applying, submit recent photograph, with details of education and experience. Apply to Box No. 3154-V.

Mechanical Engineers and Draughtsmen Required

Experienced in design and detail of boilers, pressure vessels, combustion equipment, coal and other material handling equipment, structural steel and general machinery work, etc. Good opportunity, permanent positions for men with the necessary qualifications. This is for a plant located in Winnipeg, Manitoba. When replying, state education, experience and salary expected. Apply to Box No. 3168-V.

University Of Toronto Requires Engineering 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 immediate duty and for a Special Session starting in January, 1946, at the Ajax Division, particularly in engineering drawing, descriptive geometry, and mathematics. 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.

Industrial News

Industrial development—new products—changes in personnel—special events—trade literature

C.N.R. APPOINTMENT

A. D. Macpherson, electrical engineer, department of research and development, Canadian National Railways, has been appointed controller of tests and materials research, according to an announcement by S. W. Fairweather, vice-president.

Mr. Macpherson commenced his railway service in 1918 as electrical inspector, motive power and car department at Montreal. In 1923 he was transferred to the bureau of economics in the capacity of assistant electrical engineer, taking over the duties of electrical engineer three years later.

Before entering the C.N.R. service, Mr. Macpherson held positions with the Shawinigan Water & Power Company, Northern Electric Co. Ltd., and Canadian Westinghouse Co. Ltd.

MANUFACTURING RIGHTS

The Watson-Stillman Company have announced the appointment of Canadian Vickers Limited to manufacture their entire line of hydraulic equipment in Canada. These new facilities will greatly improve the availability of W-S products and service to all Canadian users. The Canadian Fairbanks-Morse Co. Ltd. will continue to act as sole Canadian sales agents.

WATER TREATMENT

Bird Archer Co. Ltd., Montreal, Que., have issued a 38-page booklet which has been prepared as a service to those interested in the scientific approach to problems of water treatment in central power stations, railroads, steamship lines and industrial plants. The booklet points out the need for and defines water treatment and discusses with the aid of photographs, scale formation, corrosion, intercrystalline corrosion, foaming and carry-over, priming and blowdown control. Instructions are also given for water testing with this company's equipment which it describes and illustrates in addition to other of their water treatment apparatus.

JOINS C.G.E.

Gordon J. Irwin has been appointed engineer, radio division, Royce Avenue Works, Canadian General Electric Co. Ltd. Well known in the Canadian radio field, Mr. Irwin has been chief engineer of the Philco Corporation of Canada for the past ten years.

Gordon J. Irwin

L. A. Wendling

STANDARD TUBE APPOINTMENT

L. A. Wendling has been appointed assistant to E. J. Farley, general sales manager, Standard Tube Co. Ltd. Mr. Wendling has been with the company since 1940.

WARTIME RECORD

Dominion Bridge Co. Ltd. have issued a 126-page book entitled "Of Tasks Accomplished", which is a descriptive pictorial record of this company's war activities. Divided into fifteen chapters the book describes and illustrates the building of ship hulls, engines, boilers, condensers, other marine equipment and ship repairing. The manufacture of cartridge cases, shells, an anti-aircraft gun and ordnance items are also treated and the company's miscellaneous war jobs and varied wartime accomplishments, in addition to the production of cranes, pressure vessels, plate work and the construction of bridges and buildings, are described and illustrated. The book is vividly and profusely illustrated and contains photographs of workshop and field activities.

RECTIFIERS

Canadian Westinghouse Co. Ltd., Hamilton, Ont., have prepared a 4-page folder, illustrating and describing various models of plate type rectifiers. The folder contains detail views showing the construction features of this manufacturer's unit and deals with battery chargers for switchboard control and telephone systems and garage installations, industrial truck and locomotive charger units, portable engine starters and railroad car battery chargers. General purpose rectifiers are also described and illustrated and descriptions showing the solenoid mechanism of a special unit, a special unit for electrotinning, and a cathodic unit application, are also given.

CANADIAN MANUFACTURERS

Of special interest to Canadian industry in both Eastern and Western Canada is the announcement that the full line of pumps designed and produced by the Bingham Pump Company of Portland, Oregon, is to be manufactured in Canada by the Canadian Sumner Iron Works Limited, Vancouver, B.C.

The Bingham organization has arranged for Canadian incorporation, with headquarters at the offices of the Canadian Sumner Iron Works, 3550 East Broadway, Vancouver. The new company will handle sales, engineering and installation problems for their Canadian trade, while the Canadian Sumner Iron Works' staff will concentrate on production details, using the facilities of their modern plant and their wide mechanical engineering experience, coupled with the use of patterns, tools and drawings developed by the Bingham organization.

NEW CATALOGUE

The James Robertson Co. Ltd., Montreal, Que., have issued a 600-page catalogue, which contains specifications and illustrations covering an extensive selection of valves and steam goods, iron pipe fittings, copper tube and fittings, drainage fittings, pumps and water softeners, plumbing fixtures, heating equipment, etc., together with the necessary tools and equipment required for their installation and maintenance. Besides being sectionalized for easy reference, the catalogue contains both an alphabetical and numerical index of the items listed, as well as several pages of useful information and tables of value in the plumbing and heating fields

JOINS MASTER BUILDERS

Alex Graves, who for the past ten years has been in charge of the ready-mix concrete operations of S. McCord & Sons, has joined The Master Builders Co. Ltd. in the capacity of field engineer.

Mr. Graves, who is well known in the construction industry, will devote much of his time to the field development of Pozzolith in the ready-mix concrete products industries.

Alex Graves

THE ENGINEERING JOURNAL

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"To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."

★ ★ ★

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COVER PICTURE

The War Office Model of "Mulberry", the pre-fabricated harbour used in the invasion of Normandy, is now being exhibited throughout Canada under the auspices of the Hudson's Bay Company and The Engineering Institute of Canada. The cover picture shows the working model of a spud pontoon pierhead. Note the sea cut away in righthand corner so that spud may be viewed.

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ATOMIC POWER

B. W. SARGENT
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Paper presented before the Montreal Branch of The Engineering Institute of Canada on November 8th, 1945.

"At the appointed time there was a blinding flash lighting up the whole area brighter than the brightest daylight. A mountain range three miles from the observation point stood out in bold relief. Then came a tremendous sustained roar and a heavy pressure wave which knocked down two men outside the control centre. Immediately thereafter, a huge multicolored surging cloud boiled to an altitude of over 40,000 ft. Clouds in its path disappeared. Soon the shifting substratosphere winds dispersed the now grey mass."

Such was the description, according to the Smyth report, of the explosion of the first atomic bomb in the desert of New Mexico on July 16th last. This tremendous release of energy, capable of making a crater hundreds of yards in diameter and of turning the sand of the desert into molten glass, was the culmination of the efforts of a vast body of scientists working on a two billion dollar project.

A comparison of the superexplosive with coal might be made at this point. The amount of energy released in the form of heat by the combustion of one pound of coal is approximately four kilowatt-hours. The amount of energy released per pound of the active ingredient of the atomic bomb is approximately ten million kilowatt-hours. Thus pound for pound the new source provides two and a half million times more energy than the combustion of coal, while atom for atom the new source turns out to be fifty million times more effective than the combustion of coal.

Great and spectacular as the scientific effort over the period 1940-1945 was that led to the atomic bomb, it could not have been achieved so rapidly had there not been a vast body of knowledge built up over the preceding forty-odd years. The field of nuclear physics was opened with the discovery of radioactivity by Professor Henri Becquerel in 1896. When we look back on the history of nuclear physics we think of Becquerel and Pierre and Marie Curie of Paris, Rutherford of McGill and later of Manchester and Cambridge Universities, Einstein of Berlin, Bohr of Manchester and Copenhagen, Cockcroft and Walton and Chadwick of Cambridge, Lawrence of California, Fermi of Rome, and many others.

In atomic bombs and atomic power we have the world's best example of science regarded for a long time as purely academic turning out to be applied. For four decades nuclear physics grew slowly in quiet university laboratories, while industrial laboratories ignored it. While the professors of the subject had realized for a long time that nuclei were a vast storehouse of energy, the difficulty of getting more energy out of the storehouse than was required in breaking into it was regarded as very great if not insurmountable until 1939.

In view of the source of the energy, the current terms "atomic bomb" and "atomic power" might well be replaced by the more exact terms "nuclear bomb" and "nuclear power".

The First Evidence of Nuclear Energy—Radioactivity

Let us now consider some of the details of the story. The phenomenon called radioactivity was discovered as a property of uranium. Shortly afterwards the Curies discovered through its radioactivity a new element, which they named radium. The list of radioactive substances was rapidly extended by Rutherford, Soddy, and others. The property of certain heavy elements that we call radioactivity is the spontaneous emission of electrified particles. Some of these elements were found to emit *beta* rays, which are electrons travelling at high speed, while other elements were found to emit *alpha* particles, which were subsequently shown to be helium nuclei travelling at high speed. The emission of these electrified particles is often accompanied by *gamma* rays, which are similar in nature to X-rays. These particles are now known to be chips thrown out by the nuclei of these particular substances, and, since the chips are travelling rapidly, they possess energy, which has been derived from their parent nuclei. It was early shown that high pressure and high temperature had no effect whatever in speeding up or slowing down the rate of emission of these particles.

A Picture of the Atom

Let us examine more closely what is meant by the words "atom" and "nucleus". In 1911 Rutherford proposed a picture of the atom that is still more or less held by scientists. The word "atom" is of Greek origin, and arose from the idea that, if a piece of matter were subdivided over and over again into smaller and smaller pieces, ultimately one would arrive at a piece that could not be further subdivided or capable of being cut. Rutherford's picture of the atom was very different. He supposed that the atom is made up of a hard central core or nucleus surrounded by a number of electrons moving in orbits. This scheme calls to mind the solar system, and possibly the thought of the latter did prompt Rutherford. The relatively massive nucleus plays the role of the sun around which the light electrons move in orbits similar to the planets.

The essential points of Rutherford's theory are that the nucleus is extremely small and contains most of the mass of the atom, and that it possesses a positive charge of electricity equal to the total negative charges of electricity of the circulating electrons. On this view most of the volume of the atom is empty space.

We ascribe to the atom an *atomic number* Z, where Z is the number of positive charges on the nucleus, and also the number of circulating electrons in the neutral atom, each positive charge being equal to the charge on one electron. We also ascribe to the atom a *mass number* A, which may be associated almost entirely with the nucleus since the mass of the electrons is relatively negligible. It is convenient to choose mass numbers relative to 16, which is the mass number of oxygen.

Let us take some examples. The simplest atom is hydrogen, which consists of a nucleus called a proton possessing a single positive charge around which circulates a single electron. In symbols, the atomic number $Z = 1$ and the mass number $A = 1$. For helium $Z = 2$ and $A = 4$, for carbon $Z = 6$ and $A = 12$, and so on with increasing Z to the element uranium for which $Z = 92$. To this list of 92 elements there have been added recently the 93rd element called neptunium and the 94th element called plutonium. More will be said about these elements later.

Another element of interest in the present discussion is heavy hydrogen for which $Z = 1$ and $A = 2$. It will be noted that heavy hydrogen, discovered as recently as 1932, is twice as heavy as the more common light hydrogen having the mass number one. These hydrogens in chemical combination with oxygen form light water and heavy water. Now water as found in rivers, lakes, and oceans is really a mixture of these two kinds of water, the heavy water being present to only one part in five thousand.

These hydrogens are examples of *isotopes*—atoms having the same atomic number Z but different mass numbers A. Recalling that the chemical properties of elements depend on the system of extra-nuclear electrons, it follows that two or more isotopes are chemically identical. Moreover, ordinary physical properties of isotopes, while not identical, are closely similar. Since any method of separating two isotopes must depend on differences in their properties, it is easily understood why the separation is so difficult and at best very costly. If pure heavy water is required as a moderator in a chain-reacting pile it is necessary to concentrate the heavy water starting with the very unfavourable one part in five thousand.

The second relevant example of an isotopic mixture is uranium. This element as found in nature consists of atoms of mass number 238 in amount about 99.3 percent, and atoms of mass number 235 in amount about 0.7 percent, and a negligible amount of 234. The roles played by uranium 238 and uranium 235 in a chain-reacting pile will be discussed later.

The First Disintegrations Produced Artificially

Before 1919 no one had succeeded in disturbing the stability of ordinary nuclei or by any known device had changed in any way the disintegration rates of those nuclei that were naturally radioactive. In 1919 Rutherford showed that high speed *alpha* particles could cause a change in the nucleus of an ordinary element. Specifically, he succeeded in changing a few atoms of nitrogen into atoms of oxygen by bombarding nitrogen with *alpha* particles. In this experiment, in which only a few hits were registered while using about a million *alpha* particle bullets, the *alpha* particle entered the nitrogen nucleus and knocked out a proton.

Discovery of the Neutron

Experiments of exactly this kind led to the discovery of the neutron in 1932. In particular, as the result of firing *alpha* particles at atoms of beryllium and boron, Chadwick concluded that on rare occasions direct hits on the nuclei were registered causing a new kind of particle to be knocked out. This was named the *neutron*. It is uncharged and has about the same mass as the proton or hydrogen nucleus, that is, a mass of one on our relative scale. Specifically, in our notation, for the neutron $Z = 0$ and $A = 1$.

A Picture of the Nucleus

Two interesting points arose at once. One concerned the structure of the nucleus, which hitherto had remained a puzzle. It was natural to assume now that in general nuclei are built up of neutrons and protons, since Chadwick had shown that neutrons can be knocked out of certain nuclei and Rutherford had shown thirteen years earlier that protons can be knocked out of other nuclei. A nucleus with atomic number Z and mass number A would contain Z protons and A-Z neutrons. These particles are held together by electric forces with which is associated the latent energy of the nucleus.

The Neutron as a Bullet

The second point arose from the interesting property of the complete lack of charge on the neutron. Neutrons were expected to pass through atoms without disturbing or being disturbed perceptibly by the electrons and without being repelled by the charges on the nuclei as would be the case if *alpha* particles or protons were used as bullets. It seemed likely that neutrons would very easily get into nuclei and create such a disturbance that disintegration would take place. In 1934 Fermi and his collaborators bombarded a large number of stable elements with neutrons and found that many became *beta* active as a result of the capture of neutrons.

One example will suffice to illustrate these points. Figure 1 indicates what happens in three stages when a slow neutron is fired at a silver nucleus of atomic number $Z = 47$ and mass number $A = 107$. (The orbital electrons of the atom are omitted since they play no role in the nuclear change.) According to the current picture the nucleus of this stable isotope of silver is made up of 47 protons and 60 neutrons. When the oncoming neutron is captured the nuclear composition becomes 47 protons and 61 neutrons. This silver isotope is unstable, and it reverts to a stable nucleus when a neutron transforms to a proton and a *beta* particle is emitted. This resulting nucleus contains 48 protons and 60 neutrons. In other words, the atomic number is 48, which identifies the atom as cadmium, and the mass number is 108.

If an uranium nucleus of atomic number 92 and mass number 238 captures a neutron as the result of a hit it becomes an uranium nucleus of mass number 239. This isotope of uranium is *beta* active and after disintegration with the emission of a *beta* particle becomes element 93, retaining its mass number 239.

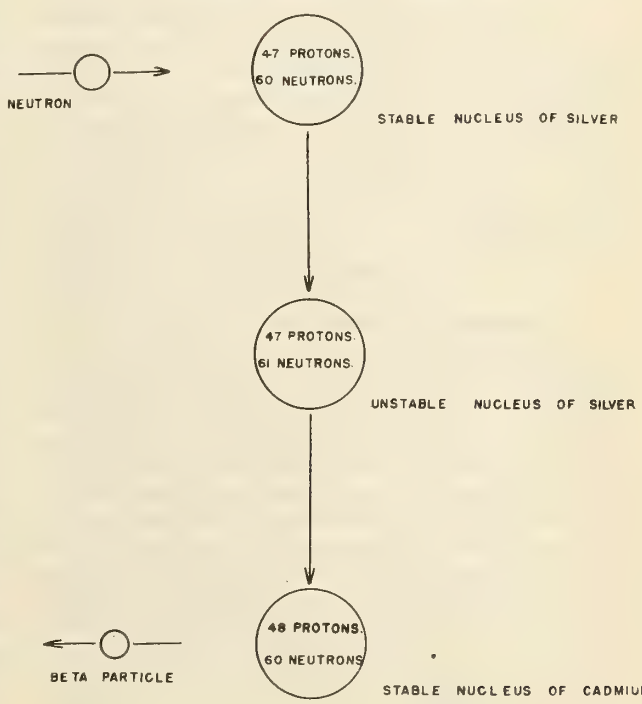

Fig. 1.

It is now neptunium (Np). Neptunium is in turn *beta* active and transforms to element 94, retaining its mass number 239. The 94th element is plutonium (Pu).

The Discovery of Uranium Fission

The study of the bombardment of uranium by neutrons led to the remarkable discovery by Hahn and Strassmann and others, in January 1939, that the capture of a neutron by an uranium nucleus sometimes causes that nucleus to split into two approximately equal parts with the release of an enormous quantity of energy. This process is called nuclear fission. It differs from the previous examples of transmutation brought about by *alpha* particles and neutrons in two ways. The bombardment of materials by these nuclear bullets caused chips to be knocked off, while in nuclear fission we have for the first time a splitting of a heavy nucleus in the strict sense. Secondly, the energy released in the fission process and appearing as kinetic energy of the two fission fragments is of the order of twenty times that carried by the chips in the earlier experiments.

The Possibility of a Chain Reaction

Much interest was aroused by uranium fission, and further discoveries were made in quick succession. The uranium isotope that had undergone fission by slow neutrons was shown to be uranium of mass number 235, the one of only 0.7 per cent presence in ordinary uranium. The fission fragments were shown to be not only barium, the one first identified by Hahn and Strassmann in Berlin, but also many others of medium atomic weight. These were found to emit *beta* and *gamma* rays. Finally, and this is very important, the process of fission was accompanied by the freeing of neutrons, in number between one and three. Here the key to the idea of a chain reaction was presented. It is evident that unless the neutrons disappearing by capture to produce fission are replenished automatically a chain reaction cannot occur.

The Chain-Reaction Problem

Let us examine how the number of neutrons may build up. One neutron is captured by an uranium nucleus of mass 235 and it splits into two fairly heavy pieces, and let us say three neutrons are set free. If each of these neutrons is in turn captured by uranium 235 causing fission we have 3×3 or 9 neutrons produced in the second generation, 3×9 or 27 neutrons produced in the next, 3×27 or 81 neutrons produced in the next generation, etc. In other words, the number of neutrons in the system builds up in a divergent chain, with the accompanying release of the energy carried by the split nuclei or fission fragments. At the beginning of such a divergent chain the number of nuclei involved is small and the heat produced is negligible, but if the chain is allowed to run away the number of atoms undergoing fission becomes enormous and the release of nuclear energy in the form of heat constitutes an explosion. In our calculation to illustrate multiplication in a chain we have said nothing about the disappearance of neutrons in ways other than capture in uranium 235 to produce fission. These other ways are of the greatest practical importance.

The question of whether a chain reaction does or does not go depends on the result of a competition among four processes:

(1) the escape of neutrons through the surface of the uranium system;
(2) the non-fission capture of neutrons by uranium, for example by uranium 238 which leads to plutonium;
(3) the non-fission capture of neutrons by other materials that may be present, such as graphite or heavy water or structural materials;
(4) the capture of neutrons in uranium 235 producing fission and freeing three neutrons per fission.

The first three processes are losses, the fourth a net gain. Their relative values can be altered considerably, as we shall see later.

If it is possible to adjust the competitive processes so that a chain reaction will occur at all, there will be a *critical size* of the uranium-containing medium. The fraction of neutrons escaping from the system obviously decreases as the size of the system is made larger. The critical size of a system is defined as the size for which the production of free neutrons by fission is just equal to the loss by escape and capture. If a system of critical size is chain-reacting and then made larger, the chance of escape of neutrons is reduced, the number of neutrons in the system begins to increase, and the power begins to run away. On the other hand, if a system of critical size is working and then made smaller, the chance of escape is increased, the number of neutrons and the power fall towards zero. It is clear that a power plant must be operated just at critical size, while a bomb must be made bigger than critical size at the moment that its explosion is desired.

The Use of a Moderator to Improve the Chances of a Chain Reaction

We shall now consider in more detail how to make the chain reaction more likely by reducing the chance of the non-fission capture of neutrons by uranium 238 and impurities and by increasing the chance of fission capture by uranium 235.

One obvious way to reduce the non-fission capture is to separate the uranium isotopes 235 and 238 on a large scale and to throw away the 238. Although this very difficult and costly method was ultimately carried out successfully in the United States to produce the fissile material—uranium 235—in concentrated form for bombs, we shall concentrate our attention on the alternative method. This method aimed to produce plutonium in large chain-reacting piles. Since plutonium is chemically different from uranium, from which it is produced, the problem of separating the two is not very difficult. Now plutonium is similar to uranium 235 in that it undergoes fission under neutron bombardment. This being the case, plutonium can be used to make bombs.

Up to this point, nothing has been said about how the chances of the various kinds of capture of neutrons by the uranium isotopes depend on the speed of the neutron. The speed at which non-fission capture is most probable is intermediate between the average speed of neutrons emitted in the fission process and the speed at which fission capture is most probable. It occurred to a number of physicists that the chances of a chain reaction could be improved if the fast neutrons emitted at the moment of fission were slowed down below the speeds at which non-fission capture in uranium was highly probable before they encountered uranium nuclei. This result could be achieved to a high degree if a slowing-down agent or moderator were introduced, and if the natural uranium were not intimately mixed with the moderator but distributed in the form of lumps.

In general, light elements are most effective as slowing-down agents or moderators. In fact, for some years before the discovery of fission, the customary way of slowing down neutrons was to pass them through material of low atomic weight, such as the hydrogeneous material, water.

In considering a possible moderator, regard must be had not only to its slowing-down property but also to its capture of neutrons. The latter should be as low as possible. Ordinary water seemed to be unfavourable on this score according to the work of Joliot, Halban, and Kowarski in 1939. Of the remaining possibilities, carbon and heavy water looked interesting.

Figure 2 is a schematic diagram of the chain reaction using a moderator.

Work Leading up to the First Chain-Reacting Pile

In June 1940, nearly all work on the chain reaction in the United States was concentrated at Columbia University, New York, under Pegram, Fermi and Szilard. Their early studies included the slowing down and capture of neutrons in graphite and the capture of neutrons in uranium 238. In July 1941, the first lattice structure of graphite and uranium oxide was set up at Columbia. It was a graphite cube 8 ft. on an edge and contained about 7 tons of uranium oxide. From measurements of the neutron densities within this cube and later in larger ones it looked more and more likely that, given *pure* graphite and *pure* uranium, a chain reaction would occur in a much larger but finite volume if the ingredients were suitably arranged.

About the same time, similar experiments were going on in the National Research Laboratory, Ottawa. These were started in 1940 by Dr. G. C. Laurence, and the author joined in the work in the summers of 1941 and 1942 when on holidays from Queen's University. These experiments were undertaken with meagre resources—uranium oxide borrowed from the Eldorado Mining and Refining Company and ten tons of petroleum coke. The latter was a dreadful black powder but the purest form of carbon that could be obtained *cheaply*. Measurements were well under way on the slowing down and capture of neutrons in the petroleum coke by the late summer of 1941, and these were followed by measurements on a lattice of uranium oxide lumps buried in the coke. We were unable to conclude definitely whether or not a chain reaction would ultimately be possible, chiefly because the materials were not pure enough and the quantities available were too small.

With increasing resources and personnel, the American physicists pushed towards their goal. The first chain-reacting pile in the world was operated for the first time on December 2nd 1942. It was built under the West Stands of the football stadium of the University of Chicago. Initially the pile was operated at a power level of half a watt, but on December 12th the level was raised to 200 watts. Briefly, the rest of this story was that with the experience gained from pilot plants the Americans built plutonium production piles and made bombs.

Let us retrace our steps a little and pick up the second thread to the story. At the time of the fall of France in 1940, part of the Paris group of physicists escaped to England, taking with them almost the world's supply of heavy water. In Cambridge the British and French pursued their investigations on the possibilities of heavy water as a moderator, which looked very promising.

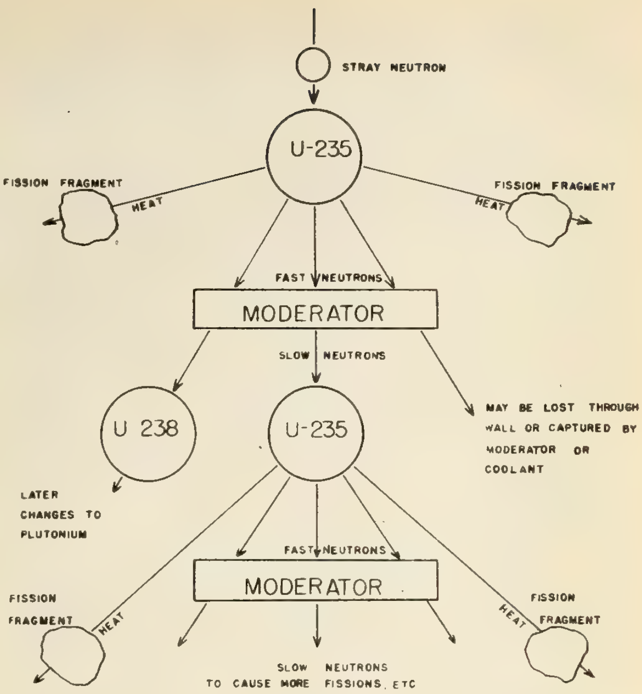

Fig. 2.

By 1942 it was felt in Great Britain that the research of the Cambridge group would proceed more quickly and efficiently if it were transferred to this continent, where the industrial facilities were not so heavily burdened by the war, and where it would be close to the natural resources of Canada and the corresponding research work in the United States. Accordingly the Montreal Laboratory was established under the administration of the National Research Council. It was to provide facilities for nuclear research by a combined group of United Kingdom and Canadian scientists and included some from New Zealand and the Free French.

Later came the agreement that Canada should build a pilot plant to make plutonium in small quantities by the natural uranium and heavy water method. The major effort of the Montreal Laboratory has been directed towards the final design of this plant, located at Chalk River, and the perfection of a chemical method for the extraction of plutonium from uranium. There is at Chalk River an extensive group of laboratories for pursuing the ramifications of the subject of nuclear energy.

Procurement of Materials

Engineers would be no doubt most interested in the technical and procurement problems that scientists and industry, particularly in the United States, have solved in a remarkably short time.

It has been pointed out that the materials going into the pile must be very pure, that is, they must be as free as possible from elements that capture neutrons strongly if the critical size of the pile is not to be too great. This demand created entirely new problems.

The graphite problem in 1942 was one of purity and priority. While commercial graphite is a remarkably pure substance, it was not pure enough. No customer had ever before cared if his graphite electrodes contained a little boron or other impurities. Following suggestions made by experts at the Washington Bureau of Standards, two carbon companies were able to produce highly purified graphite with a neutron absorption some 20 per cent less than the standard commercial materials previously used, and large orders were placed for plant construction.

At the end of 1941, only a fraction of a pound of uranium metal was in existence. The raw material was a limited amount of black oxide obtainable from Canadian sources. It contained 2 to 5 per cent of impurities. By May 1942, deliveries averaging 15 tons a month of black oxide of higher purity and more uniform grade started coming in. Total impurities were less than one per cent, but this was too much. An ether extraction method was devised at the National Bureau of Standards, Washington, and put into industrial operation by a chemical works. By this process about a ton a day of impure commercial oxide was transformed to oxide of a degree of purity seldom achieved even on a laboratory scale.

The difficulties of making metal from the oxide were also overcome by the end of 1942, and some six tons of the metal were incorporated in the first pile built at Chicago. The first process cost about $1,000 a pound and was slow. The final processes were simple, rapid and cheap.

In 1940, the world's supply of heavy water was less than 500 pounds, and had come from the Norwegian plant, which fell under German control. Two methods of concentrating heavy water were known—fractional distillation and the hydrogen-water exchange reaction. Each requires a large installation and the expenditure of much heat or electrical energy for large scale production. Such plants have been put into operation by the du Pont Company in the United States and by the Consolidated Mining and Smelting Company at Trail, B.C.

Problems of Pile Design

We have noted that a lattice arrangement of uranium metal in a moderator of graphite or heavy water is most economical of materials. If the uranium were in lumps it would be difficult to remove them in order to send them to the plutonium extraction plant. Secondly, it would be difficult to concentrate the coolant at the lumps, which are the hot spots. Both these difficulties are avoided if a rod lattice rather than a lump lattice is used.

The critical size of the chain-reacting system must be known in advance of construction. Physicists determine this by making measurements on a system that is usually much smaller than critical size. This type of investigation has been dealt with in reviewing the American work on the uranium and graphite lattice, which lead to the first chain-reacting pile. Similar work on uranium and heavy water has been part of the research programme of the Nuclear Physics Division in Montreal. It is possible to reduce the critical size by the use of a reflector of neutrons such as a graphite wall built around the uranium containing unit, the wall reducing the loss of neutrons from the latter.

If river water is used as a coolant it has to be conveyed in pipes through the reacting unit. The choice of the pipe material is limited by nuclear physics considerations. In particular its capture of neutrons must be small. Further, the material must not fall apart under intense neutron and *gamma* radiation, and it must not leak, corrode nor warp. Of the few possible metals, aluminum was chosen for the American production plants.

In order to prevent corrosion of the uranium by the water and to prevent dangerously large amounts of fission products from being carried along in the stream, the uranium rods must be jacketed in a suitable metal. These jackets must be tight and remain tight during operation. Here again the choice of metal is limited by nuclear physics as well as engineering considerations.

If the power of the plant is high the water requirements are considerable. A pumping station and a filtration and water treatment plant may be necessary. The water system has to be most reliable, and it is wise to provide fast operating controls to shut down the chain-reacting unit in a hurry in case of failure of the water supply. If the once-through cooling instead of recirculation is adopted, a retention basin is provided so that radioactivity induced in the water will die before it is returned to the river.

Since the neutrons that maintain the chain reaction and the *gamma* rays from the accumulated fission products are damaging to biological tissue, thick concrete shields around the unit are necessary to protect personnel.

The choice of electric insulating materials for instruments buried in the pile for power measurement must be carefully considered, for they must not lose their insulating property under irradiation.

The control of the power is relatively easy. Strips of cadmium or boron steel, which capture neutrons strongly, may be inserted in the pile and used for fine control by moving them in or out slowly or for emergency shutdown by moving them in quickly.

When the plutonium has accumulated sufficiently in a rod it must be withdrawn and taken to the chemical plant. The fission products in the rod emit *beta* and *gamma* rays, and therefore one cannot approach it unshielded. Chemical operations have to be done behind heavy concrete shields, and be directed by remote control. The extraction method must separate plutonium from uranium and the dangerously active fission products comprising some thirty elements that have mass numbers approximately in the ranges 127 to 154 and 83 to 115. The amount of plutonium to be extracted from tons of uranium is small. The choice of extraction process was based on the chemical properties of plutonium worked out in the laboratory on less than one milligram.

At an assumed rate of one kilogram of plutonium a day, a 500,000 to 1,500,000 kilowatt plant is required, which may be compared with the capacity—2,000,000 kilowatts—of the hydroelectric plants at the Grand Coulee Dam.

The Immediate Future of Nuclear Energy

What about the immediate future of nuclear energy that can be derived from uranium 235 and plutonium? In thinking of the future, certain limitations must be kept in mind. Chain-reacting piles are large and must be surrounded by very heavy shields. Once a unit has been operated at appreciable power it is impossible to go inside the shield, even when the plant is shut down, to make adjustments or effect repairs, owing to the hazard of the *gamma* radiation.

It seems, therefore, that nuclear power units of the pile type will be used only in very special cases. A large stationary power installation might be used for heat and motive power in the Arctic or Antarctic regions far removed from water power and where the difficulty of transporting other fuels such as coal or oil outweigh the disadvantages and difficulties of operating and maintaining a nuclear power plant. One can hardly envisage in the near future the use of nuclear power for propulsion except perhaps in battleships or large rockets. It should be remembered too that the basic fuels for nuclear power—uranium 235 and plutonium—are in short supply.

The most interesting uses of nuclear energy and the most beneficial for humanity lie in other fields. The practical uses of radium were always severely restricted by its cost—a million dollars an ounce. Vast amounts of radioactive materials—the fission fragments—accumulate in the uranium in a plant such as that at Chalk River. Moreover, almost any material inserted inside the concrete shield will become intensely radioactive. We have now the prospect of new and far-reaching applications of these cheap radioactive materials in industry, biology, and medicine.

In industry these materials may be used to supplement radium and X-rays for the radiographic inspection of castings, welds, forging, etc.

In biochemistry and pharmacology these materials will permit the fullest applications of the tracer method in studying the movement of specific atoms through an organism. For example, some of the atoms of a drug are made radioactive in the pile before being used, and thereafter they can be located in the body by their radioactivity.

In the treatment of cancer these new radioactive materials will greatly supplement radium and X-rays, and make possible cheap but effective treatment at many clinics. These developments will take a little time, for the doctors and physicists working together must first adapt radiological techniques to the properties of the new materials and then acquaint the practising physicians with the techniques. A graduate school in Medical Radiology in one of our universities is now greatly needed to give young radiologists the full and comprehensive training required in this greatly extended field of service.

The Future of the Chalk River Establishment

Everyone of us has a small stake in the Chalk River establishment, for it was with our money that the Federal Government built it. For the first time in our history we have in Canada a research establishment that is second to none anywhere. Canada has got off to a good start in the field of atomic energy. Having made the investment you have the right to ask that the research facilities provided on such a magnificent scale be used to the utmost to keep us in the forefront of new developments. Of course financial support will be necessary year by year to operate the plant, to keep the laboratory equipment up to date, and to maintain the research staff in effective strength. The days have gone when it was possible for a lone physicist to make discoveries with a tin box, a piece of wire and a stick of sealing wax. In deciding on an adequate strength of staff we must beware of being unduly influenced by our pre-war conception of numbers, for there were then no facilities of the same magnitude. Moreover, the salaries for research staff do not predominate over other separate costs, and even the annual total does not approach the capital cost.

Granted financial support, the next question is whether an adequate staff of Canadian scientists can be maintained and expanded to take care of the vacancies created when some of our colleagues from the United Kingdom return home. Trained scientific workers with imagination will be needed. Since Canada's population is not large, in the best of times we have not a large body of trained research workers to draw on. Moreover, we may have to contend with the implication in the remark that someone made before the war: " Canada's highest quality exports to the United States are whisky and brains ". The expanding economy and the havoc war wrought in the flow of research workers from the universities means that a scarcity of such workers prevails almost everywhere in the world today. In spite of these difficulties, it should be evident that, given satisfactory living and working conditions and freedom of expression which make for happiness, the right scientists will be attracted to the establishment. From what I have seen already, I have good reason for feeling optimistic.

There is another point that should be mentioned. Scientists at Chalk River are in fairly general agreement that the atmosphere of the establishment should tend towards that in a thriving university laboratory. Lecture courses and seminars should be held, not for credits towards degrees, but to train newcomers and generally to keep the staff informed on new developments. It is desirable also that research students in the universities should have the opportunity to use some of the facilities. Of course it may not be possible to provide space and research apparatus for all who may wish to seize such an opportunity. The training of research workers in the laboratories of the universities and the National Research Council is obviously of the utmost importance for the future. Any widening of opportunity of the type suggested here may only be possible if the secrecy regulations are moderated.

Wars have interrupted the otherwise continuous thread of friendliness and cooperation among the scientists of the world, who seem to have practised internationalism better than any other group. Instances of this spirit have been many.

In 1908 the Vienna Academy of Sciences helped Rutherford in his work by the loan of 300 milligrams of radium free of cost. After the First World War it seemed as though the radium would be confiscated by the British as enemy property. Rutherford intervened and had it released. Some years later when the financial difficulties of the Vienna institutes were at their climax, he bought the radium and so enabled research in Vienna to be carried on. A more generally known instance of the cooperation of scientists was the generous treatment that the refugee scientists from the Fascist countries received in Great Britain and the United States. It will be a great pity, indeed a hindrance to progress, if this spirit of friendliness and cooperation does not return.

AIRCRAFT PERFORMANCE TESTING AND REDUCTION BY THE "iw" Method

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Theory

The so-called "iw" method for the determination of aircraft performance in a standard atmosphere from flight tests carried out from day to day under non-standard conditions has become very popular in recent years. The basis of the method is by no means new, having been indicated as a performance reduction system as long ago as 1920 ("Applied Aerodynamics" by L. Bairstow).

Consider an aircraft in level flight in a non-standard atmosphere. Let W be the instantaneous weight of the aircraft, V the steady level true air speed for a brake horsepower output P, and N the rotational speed of the propeller. Assume that the altitude is such that the air density is ρ. The "iw" method consists in determining, from this flight test data, what the new speed and necessary power output would be if the aircraft were flying at the *same angle of attack* but at sea level in the standard atmosphere and at some new weight conveniently chosen as the standard weight, at which performance figures are required.

Let W_s be the arbitrarily chosen standard weight,
ρ_o be the sea level air density in the standard atmosphere,
V_{iw} be the new true air speed,
P_{iw} be the new power output,
N_{iw} be the new propeller rotational speed.

For level flight we have:—

$$C_L = \frac{L}{1/2\,\rho V^2 S} = \frac{W}{1/2\,\rho V^2 S}$$ in the actual test flight

case and since the angle of attack and therefore the lift coefficient is to remain unchanged,

$$C_L = \frac{W_s}{\frac{1}{2}\rho_o V_{iw}^2 S}$$ in the hypothetical standard case.

Equating the two expressions $\dfrac{W_s}{\frac{1}{2}\rho_o V_{iw}^2} = \dfrac{W}{\frac{1}{2}\rho V^2}$

$$\text{or} \quad V_{iw}^2 = \frac{W_s}{W} \cdot \frac{\rho}{\rho_o} \cdot V^2$$

$$\text{or} \quad V_{iw} = \frac{\sqrt{\sigma}\,V}{(W/W_s)^{1/2}} \qquad \text{——— (1)}$$

($\sqrt{\sigma}V$ is the "true indicated air speed" in American terminology and is the "equivalent air speed" in British terminology.)

where σ is the relative density at the altitude and time of test. Knowing σ, W and having measured V, this formula enables the calculation of the new speed at sea level in standard air at weight W_s, necessary to maintain level flight at the same angle of attack as existed in the test measurement.

In the flight test measurement,

$$C_D = \frac{D}{\frac{1}{2}\rho V^2 S}$$

but $D\,V = \eta\,P$ where η is the propeller efficiency

$$\therefore \quad C_D = \frac{\eta P}{\frac{1}{2}\rho V^3 S}$$

Now, in the hypothetical sea level case the angle of attack is assumed to be held unchanged from the flight test value, hence the drag coefficient will be unchanged.

$$\text{hence } C_D = \frac{\eta_s P_{iw}}{\frac{1}{2}\rho_o V_{iw}^3 S} = \frac{\eta P}{\frac{1}{2}\rho V^3 S}$$

where η_s is the propeller efficiency in the hypothetical standard case. Assuming for the moment that this too remains unchanged ($\eta_s = \eta$)

$$\text{Then } P_{iw} = \frac{P}{\sigma} \cdot \left(\frac{V_{iw}}{V}\right)^3$$

Substituting for V_{iw} from equation (1).

$$P_{iw} = \frac{P}{\sigma} \cdot \left(\frac{\sqrt{\sigma}}{(W/W_s)^{1/2}}\right)^3$$

$$\text{or} \quad P_{iw} = \frac{\sqrt{\sigma}\,P}{(W/W_s)^{3/2}} \qquad \text{——— (2)}$$

an expression for the new engine power required at the new speed and weight W_s in standard air at sea level.

Let us examine the assumption that the propeller efficiency is unchanged in going from the actual flight test case to the hypothetical standard case.

The efficiency of a propeller is a function of J $\left(\text{the dimensionless parameter } \dfrac{V}{Nd}\right)$ and the power coefficient $C_P = \dfrac{P}{\rho N^3 d^5}$

For the flight test case we have:—

$$C_P = \frac{P}{\rho N^3 d^5} = \frac{PJ^3}{\rho V^3 d^2}$$

and for the standard case:—

$$C_P = \frac{P_{iw} J_s^3}{\rho_o V_{iw}^3 d^2}$$

substituting for P_{iw} and V_{iw} from equations (2) and (1).

$$C_P = \frac{\sqrt{\sigma}P}{(W/W_s)^{3/2}} \cdot \frac{J_s^3 (W/W_s)^{3/2}}{\rho_o(\sqrt{\sigma}V)^3 d^2} = \frac{PJ_s^3}{\rho_o \sigma V^3 d^2} = \frac{PJ_s^3}{\rho V^3 d^2}$$

and it is obvious that if J remains unchanged, in going from the actual to the hypothetical standard case, then C_P is also unchanged and since the efficiency is a function of J and C_P, then the efficiency is unchanged.

$$\text{Hence } \frac{V_{iw}}{N_{iw} d} \text{ must equal } \frac{V}{Nd}$$

$$\text{i.e.} \quad N_{iw} = \frac{V_{iw}}{V} \cdot N$$

$$\text{or} \quad N_{iw} = \frac{\sqrt{\sigma}\,N}{(W/W_s)^{1/2}} \qquad \text{——— (3)}$$

This equation gives the rotational speed of the propeller in the hypothetical standard case, necessary to retain an unchanged propeller efficiency.

If level flight speeds are measured in the tests at various altitudes and over as wide a range of engine powers as possible, then a family of curves can be drawn for sea level in a standard atmosphere showing the relationship between level speed and engine power (at the standard weight) for various values of N_{iw}, the sea level propeller speed. For this to be accomplished, of course, the power P developed by the engine in the flight tests must be known. The use of a torquemeter gives the most reliable method for determining the power but reliable engine power charts have proved very satisfactory.

From the level speed versus power curves at sea level, the level speed at altitude in a standard atmosphere can be determined by the reverse process, for any required power setting. Using power curves to give the engine power P at height, P_{iw} can be calculated for the appropriate height. The P_{iw}, V_{iw} curve then gives the corresponding value of V_{iw} and hence V the true speed.

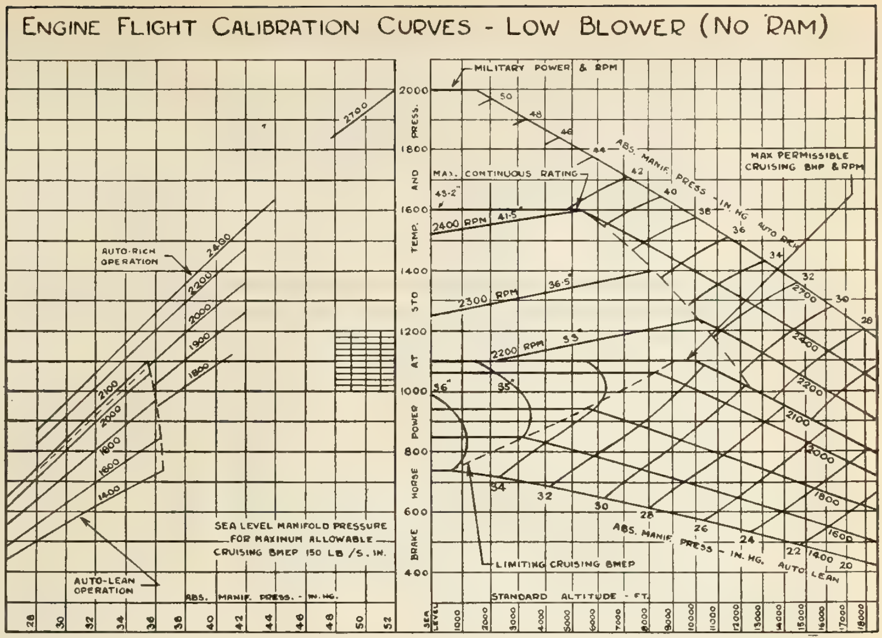

Fig. 1.

The treatment of climb performance is done in a similar fashion.

Consider the aircraft in steady climbing flight in the non-standard atmosphere.

Let W be the instantaneous weight of the aircraft
- V the true air speed
- C the steady rate of climb
- P the power output from the engines

Assuming that the angle of attack and the geometrical angle of climb are unchanged, then in the standard atmosphere at sea level—

If W_s is the standard weight
- V_{iw} is the new air speed
- C_{iw} is the new rate of climb
- P_{iw} is the new power output required from the engines

Then $C_L = \dfrac{L}{\frac{1}{2}\rho V^2 S} = \dfrac{W \cos\theta}{\frac{1}{2}\rho V^2 S}$ (where θ is the angle of climb) for the actual test flight case, and

$C_L = \dfrac{W_s \cos\theta}{\frac{1}{2}\rho_o V_{iw}^2 S}$ for the hypothetical standard case and as for level flight it follows, by equating, that

$$V_{iw} = \frac{\sqrt{\sigma}\, V}{(W/W_s)^{1/2}}$$

Now the rate of climb $C = V \sin\theta$ for the flight test, and for the sea level standard case, at the same angle of climb,

$$C_{iw} = V_{iw} \sin\theta = \frac{V_{iw}}{V} \cdot C$$

substituting for V_{iw}:—

$$C_{iw} = \frac{\sqrt{\sigma}\, C}{(W/W_s)^{1/2}} \qquad (4)$$

In climbing flight we have—

$$T = D + W \sin\theta \text{ where } T \text{ is propeller thrust}$$

$$\therefore\ TV = DV + WV \sin\theta = \eta P$$

or $DV = \eta P - WC$

i.e. $C_D \cdot \frac{1}{2}\rho V^3 S = \eta P - WC$

or $C_D = \dfrac{\eta P - WC}{\frac{1}{2}\rho V^3 S}$

For the sea level standard case

$C_D = \dfrac{\eta P_{iw} - W_s C_{iw}}{\frac{1}{2}\rho_o V_{iw}^3 S}$ (assuming the same value of η)

Equating the values of C_D (same angle of attack) gives

$$\eta P_{iw} - W_s C_{iw} = \frac{\rho_o}{\rho} \cdot \left(\frac{V_{iw}}{V}\right)^3 \cdot (\eta P - WC)$$

$$\text{or } \eta P_{iw} = W_s C_{iw} + \frac{1}{\sigma}\left(\frac{V_{iw}}{V}\right)^3 \cdot (\eta P - WC)$$

Substituting for C_{iw} and V_{iw}

$$\eta P_{iw} = W_s \cdot \frac{\sqrt{\sigma}\, C}{(W/W_s)^{1/2}} + \frac{1}{\sigma} \cdot \left(\frac{\sigma}{W/W_s}\right)^{3/2} \cdot (\eta P - WC)$$

$$= W \cdot \frac{\sqrt{\sigma}\, C}{(W/W_s)^{3/2}} + \frac{\sqrt{\sigma}\, \eta P}{(W/W_s)^{3/2}} - \frac{W\sqrt{\sigma}\, C}{(W/W_s)^{3/2}}$$

$$= \eta \cdot \frac{\sqrt{\sigma}\, P}{(W/W_s)^{3/2}}$$

or $P_{iw} = \dfrac{\sqrt{\sigma}\, P}{(W/W_s)^{3/2}}$ as for the level flight case

The assumption that propeller efficiency is unchanged is again valid if J is unchanged, which leads to

$$N_{iw} = \frac{\sqrt{\sigma}\, N}{(W/W_s)^{1/2}} \qquad \text{as before.}$$

If rates of climb are measured in the tests at various air speeds for substantially constant powers, repeating the tests at various power settings, then a family of climb curves can be drawn for sea level in a standard atmosphere showing the relationship between rate of climb and speed (at the standard weight) for each power setting (P_{iw}) at various values of N_{iw}. Level speed values can also be plotted, where $C_{iw} = 0$.

From the sea level curves the maximum rates of climb can be read off and the corresponding best speed (V_{iw}) for the climb. The maximum rates of climb at altitude in a standard atmosphere, for any given power setting, can be deduced by a reverse process similar to that outlined for level speeds.

The "iw" method of performance reduction as outlined above does not take account of compressibility effects and cannot therefore be expected to hold rigorously when such effects are present to any considerable extent in the operation of the aircraft or the propeller. However, this is true also for all other known methods of performance reduction.

In using the method, the effect of varying propeller speed (N_{iw}) at constant power has only a minor effect, due to the changes in propeller efficiency being only slight, and in some cases no systematic effect has been separable from the flight test results.

Flight Testing

Upon receipt the aircraft is given careful examination during its acceptance check, for the purpose of determining its general condition and compliance with design. Rigging dimensions, propeller pitch settings, location of the pressure head, control settings, etc., may be verified.

The following instruments are removed and calibrated:—Outside air temperature gauge; Air speed indicator (a sensitive air speed indicator with 1 m.p.h. graduations is necessary and should be installed if not provided with the aircraft); Engine tachometers; Boost pressure gauges; Sensitive altimeter; Carburettor air temperature gauge.

If information is required on the engine installation the following should also be calibrated: Cylinder head temperature gauge; Oil temperature gauge; Oil pressure gauge. In this case further instrumentation may be required such as thermocouples installed at various points on the engines, fuel flow meters, etc.

A fuel contents gauge is useful as a check on the fuel consumed, when determining the weight of the aircraft during the tests. In general the quantity of fuel necessary to refill the tanks after flight is used as the basis for weight determination, this quantity being obtained from the meter of the refuelling truck.

The aircraft is next weighed and its centre of gravity is determined, with full fuel and oil and full payload and crew. In many cases the tare weight and centre of gravity are required and often the weighing is required at some intermediate loading. It is essential in flight testing to have an accurate knowledge of the weight prior to take-off and at the commencement and completion of each series of tests. All weighing is done with the aircraft in flying position and the undercarriage

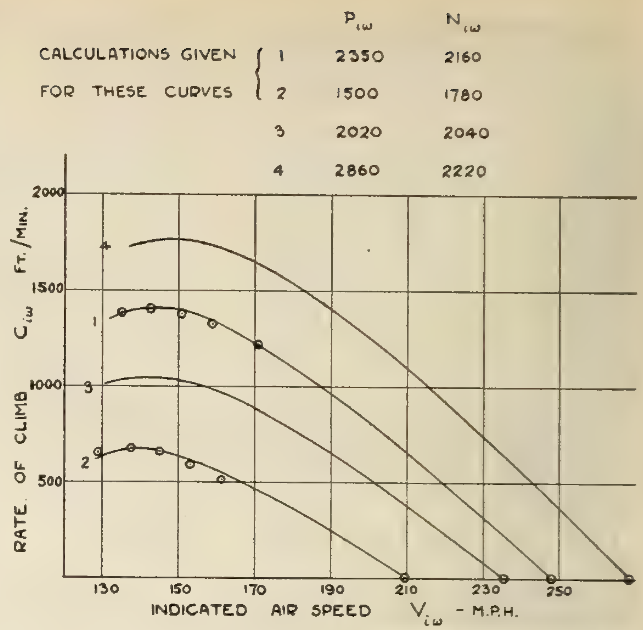

Fig. 3—Ventura Aircraft. $W_s = 22500$ lb. (Sea Level Standard Atmosphere).

extended. The effect on the centre of gravity of raising the undercarriage should be allowed for.

To facilitate the closest possible determination of the weight of the aircraft at any instant during the flight tests, a record is kept of the elapsed time, from the instant of take-off, making reasonable allowance for the fuel consumed during run-up of the engines and taxiing to the take-off point. It is also advantageous if fuel can be drawn from one set of tanks for take-off and climb to altitude, changing to another set of tanks for the flight tests and landing or, alternatively, the take-off, climb and flight tests can be done using one set of tanks, the change-over to the other set of tanks being made upon completion of the tests. Having determined the total fuel consumed during the tests, it is accurate enough to proportion this on a time basis in order to deduce the weight at the time of any given test. Depending on when the change-over to the second set of tanks is made some estimate must be made either of the fuel consumed in take-off and climb prior to commencing the tests or of the fuel consumed in landing, after completion of the tests. This latter quantity may be kept small if the tests can be so arranged as to terminate close to the aerodrome.

The determination of the stalling speed (A.S.I. reading) is usually the first flight test carried out. This test is done at a total weight as close as possible to the maximum gross weight. Results can be subsequently corrected for slight variations in weight, using the A.S.I. position error (to be determined later) to give the true air speed, correcting this for weight variation and reapplying the position error to give the new A.S.I. reading. Tests are made at any reasonably safe altitude, with engines fully throttled and propellers in fine pitch. It is generally

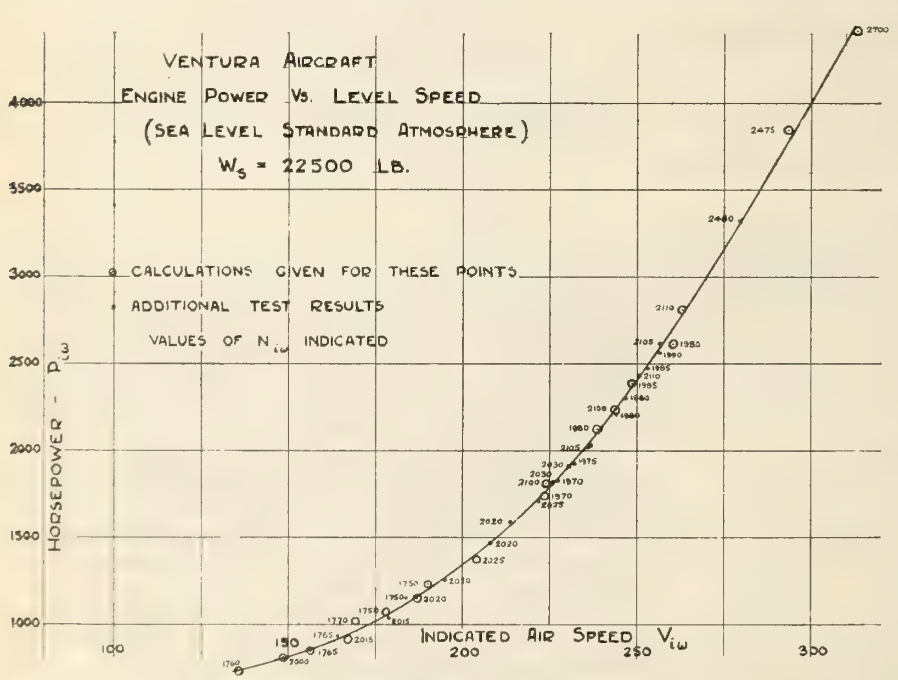

Fig. 2.

TABLE I
LEVEL SPEED TESTS

Time	Height I.C.A.N.	A.S.I.	Air Temp.	Carb. Air Temp.	RPM	Manifold Pressure	A.S.I. Corrected: Instrument Error	A.S.I. Corrected: Pos'n Error $\sqrt{\sigma}V$	Alt. Corrected	Weight	$\sqrt{\sigma}$	w/w_s	$(w/w_s)^{1/2}$	$(w/w_s)^{3/2}$	P Auto. Rich	P Corrected for Carb. Air Temp.	$\sqrt{\sigma}P$	V_{iw}	P_{iw}	N_{iw}
	ft.	m.p.h.	°C	°C		inches	m.p.h.	m.p.h.	ft.	lbs.					h.p.	h.p.		m.p.h.	h.p.	
1507	Take-off									22970										
1513	4100	223	−22.5	0	2000	30	224.9	225.0	4030	22864	0.993	1.016	1.008	1.024	1772	1794	1782	223.3	1740	1970
1523	4100	239	−22.5	−5	2000	34	240.0	239.3	4030	22687	0.993	1.008	1.004	1.012	2120	2166	2151	238.4	2126	1978
1530	4100	250	−22.5	−5	2000	37	251.0	248.9	4030	22563	0.993	1.003	1.0015	1.005	2364	2415	2400	248.5	2388	1983
1538	4100	260	−20.0	−5	2000	40	261.2	259.8	4030	22420	0.989	0.996	0.998	0.9904	2560	2615	2587	260.3	2612	1982
1550	4100	138	−22.5	−5	2000	20	138.3	147.7	4030	22207	0.993	0.987	0.9935	0.980	784	801	796	148.7	812	1999
1556	4100	158	−25.0	+5	2000	21	158.5	165.3	4030	22101	0.997	0.982	0.991	0.9703	888	891	888	166.8	915	2012
1604	4100	179	−25.0	0	2000	23	180.5	184.7	4030	21959	0.997	0.976	0.988	0.9604	1094	1108	1105	186.9	1152	2018
1611	4100	197	−25.0	0	2000	25	199.0	201.2	4030	21835	0.997	0.971	0.985	0.9507	1296	1312	1309	204.1	1376	2024
1628	500	285	−20.0	−5	2300	45	287.4	286.8	500	21532	1.052	0.957	0.978	0.9306	3290	3401	3580	293.4	3846	2474
1633	500	304	−20.0	0	2500	50	307.5	305.6	500	21443	1.052	0.953	0.976	0.930	3810	3904	4110	313.1	4420	2695
1640	Landed. 233 gallons of fuel used																			
0957	Take-off									23410										
1009	10000	188	−22.5	0	2000	25	190.0	193.1	9885	23215	0.888	1.032	1.016	1.048	1468	1455	1293	190.0	1234	1748
1015	10000	174	−22.5	0	2000	23	175.7	180.4	9885	23117	0.888	1.0275	1.014	1.042	1274	1263	1122	177.9	1077	1751
1026	10000	126	−22.5	+16	2000	19	126.0	137.1	9885	22939	0.888	1.020	1.010	1.030	880	847	752	135.7	730	1758
1033	10000	149	−22.5	0	2000	20	149.5	157.4	9885	22826	0.888	1.014	1.007	1.021	980	972	863	156.3	845	1764
1040	10000	163	−23.0	0	2000	22	164.0	170.1	9885	22713	0.839	1.010	1.005	1.015	1176	1166	1036	169.2	1021	1769
1050	800	222	−22.5	−5	2000	30	224.0	224.2	800	22551	1.0515	1.002	1.001	1.003	1674	1728	1818	223.9	1813	2101
1056	750	243	−22.5	0	2000	34	244.2	243.3	750	22464	1.0525	0.998	0.999	0.9907	2050	2099	2209	234.6	2230	2107
1105	850	262	−22.5	−3	2000	40	263.4	261.9	850	22317	1.050	0.992	0.996	0.9808	2550	2623	2754	263.0	2807	2108
1120	Landed. 192 gallons of fuel used.																			

TABLE II

Twin-Engine Climb Tests at Mean Altitude (I.C.A.N.) 5500 ft. at 2400 R.P.M. and Manifold Pressure (Corrected) 35¾″, Auto. Rich and Mean Altitude (I.C.A.N.) 7500 ft. at 2000 R.P.M. and Manifold Pressure (Corrected) 27½″, Auto. Lean

A.S.I. Reading M.P.H.	A.S.I. Corrected V_1	Air Temp. °c	Observed Rate of Climb ft./min.	Corrected Rate of Climb ft./min.	Mean Rate of Climb ft./min.	B.H.P.	Carb. Air Temp. °C	Corrected B.H.P. P	W lb.	W/W_s	$(W/W_s)^{\frac{1}{2}}$	$(w/w_s)^{3/2}$	$\sqrt{\sigma}$	V_{iw}	C_{iw} ft./min.	P_{iw}	Average P_{iw}	C_{iw} Corrected to Avge. P_{iw}	N_{iw}
165	171.9	+17	1268	1327		2690													
"	"	"	1288	1348	1338	"	+17	2628	22777	1.012	1.006	1.018	.898	170.9	1194	2318	2350	1221	2140
150	159.1	"	1388	1453		"													
"	"	"	1428	1495	1474	"	"	2628	22542	1.001	1.001	1.004	"	159.0	1323	2350	"	1323	2150
140	150.4	"	1501	1572		"													
"	"	"	1477	1546	1559	"	"	2628	22386	.995	.997	.992	"	150.8	1403	2378	"	1379	2160
130	141.8	"	1528	1600		"													
"	"	"	1538	1610	1605	"	+16	2630	22229	.988	.994	.981	"	142.6	1450	2408	"	1401	2170
120	133.7	+21.5	1528	1624		"													
"	"	"	1528	1624	1624	"	+11	2654	22073	.981	.990	.970	.891	135.1	1461	2438	"	1386	2160
150	159.1	+15	525	554		1640													
"	"	"	500	528	541	"	+6½	1620	21917	.974	.987	.961	.869	161.2	476	1465	1500	506	1760
140	150.4	+14.5	623	656		"													
"	"	"	611	644	650	"	+6	1622	21760	.967	.983	.950	"	153.0	574	1484	"	588	1765
130	141.8	+12	710	742		"													
"	"	"	702	733	737	"	+12	1604	21447	.954	.977	.931	.874	145.2	659	1506	"	654	1790
120	133.7	+12	710	742		"													
"	"	"	730	762	752	"	+11	1606	21604	.960	.979	.940	"	137.5	671	1493	"	677	1785
110	125.2	+12	706	737		"													
"	"	"	732	764	750	"	+12½	1604	21291	.946	.972	.919	"	128.7	674	1526	"	652	1795

required that the stalling speed be measured for flaps and undercarriage up and for flaps and undercarriage down. Gills and shutters will normally be closed. If the stall is more vicious with power-on, tests may also be required with flaps down and partial power. The pilot will maintain level flight during the tests, closing the throttles and moving the control column back as slowly as possible, maintaining the aircraft laterally level. The stalling speed is taken as that speed at which the nose or one wing drops uncontrollably.

The measurement of position error for the air speed indicator and altimeter is then made. Several methods are available but, of these, the speed-course method is quite satisfactory for low and medium speeds. The aneroid method is excellent particularly for high speed aircraft. The formation method, using a calibrated aircraft, works well when atmospheric conditions are good and when an adequate method of communication between the two aircraft is available. Before conducting the position error determination, the A.S.I. system should be checked for leaks and, in fact, throughout the flight tests a daily check should be made to ensure absence of leaks. The A.S.I. position error tests should be conducted at an all-up weight as close as possible to the standard weight W_s chosen for the performance reduction. The tests are made over the entire speed range of the aircraft in suitable increments, flaps and undercarriage up and, if required, at some speeds with flaps down.

In using the speed course method, a suitable course is required in the neighbourhood of three miles in length. Weather conditions must be ideal and free from turbulence, with the least wind possible. High or gusty wind conditions are to be avoided. The aircraft is flown in both directions over the speed course at each selected air speed and timed over the course. A height of about 100 feet is usually desirable, if conditions will allow. It is essential to secure steady level flight conditions before entering the speed course and the aircraft must be kept in level flight throughout the run, with the air speed constant within ± 1 m.p.h. If the strength of the wind is known, then the true air speed is given by the following formula:—

$$V = \sqrt{V_w^2 + V_1 \cdot V_2}$$

where V_w = wind speed; V_1 and V_2 are the measured ground speeds up and down the course.

From the true air speed the true indicated air speed (equivalent air speed) is calculated by multiplying by $\sqrt{\sigma}$, derived from the pressure height and outside air temperature, and hence the position error is deduced by a comparison with the A.S.I. reading. The pressure height is read directly from the sensitive I.C.A.N. altimeter provided this has been set to 29.92 in. (or 1013.2 millibars) which is a routine procedure throughout the flight testing.

The altimeter position error is to be determined because the readings of the altimeter are affected by errors in the static pressure given by the pitot-static head. The altimeter is set to read zero when located on the roof of a conveniently situated hangar. The aircraft, with the altimeter installed, is then flown past the roof of the building at various speeds throughout the speed range, the pilot flying level with the roof. An observer stationed on the roof, with the necessary simple equipment, can determine errors in the height of the aircraft and so increase the accuracy of the method. The pilot reads the altimeter and, by the difference between its reading and the true height, determines the position error at each speed.

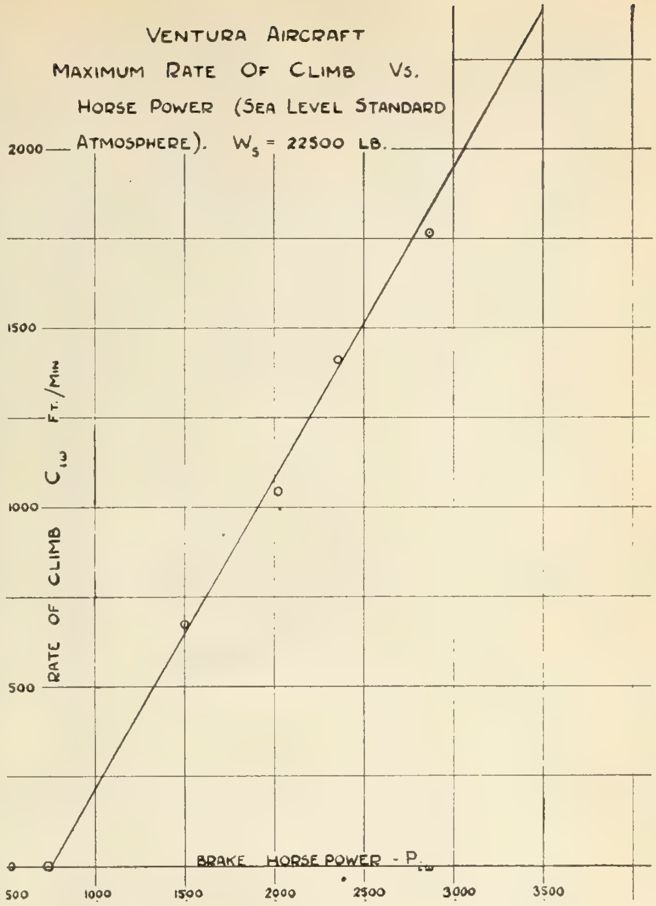

Fig. 4.

The next stage in the flight testing is the measurement of level speed performance. In these tests as in all others, two prime requirements should be noted. The first concerns the atmospheric conditions. It is a waste of time to attempt the measurement of aircraft performance when turbulent conditions exist in the atmosphere. The presence of vertical currents will completely upset speed and climb tests. It is therefore necessary to restrict all testing to periods when the air is quiescent. In summer this means early morning flying, and sometimes evening flights are possible although, in general, turbulent conditions created during the day may persist into late evening. In winter, after the passage of a cold front and when the wind strength has decreased, conditions are usually good and, again, good conditions are often to be found in warm air masses. Despite care in picking the times for flight testing, many false starts will be made and flights will be abandoned because conditions are unexpectedly poor or deteriorate after commencement of the tests. Visible clouds must always be avoided because these are usually an indication of vertical currents and, in general, no tests should be made at the altitude of the cloud-forming layer. One advantage of the "iw" method is that any altitude can be used and the choice of high altitudes for most of the tests gives a better chance of smooth conditions. The second requirement is that the pilot must be trained in test flying. If the pilot is not so trained, flight test time and accuracy will be lost. Test flying is extremely exacting insofar as the pilot is concerned, requiring a high degree of skill and considerable experience in this type of work.

In carrying out the level speed tests it is vitally important to allow sufficient time for the aircraft to become stabilized. This time increases very considerably

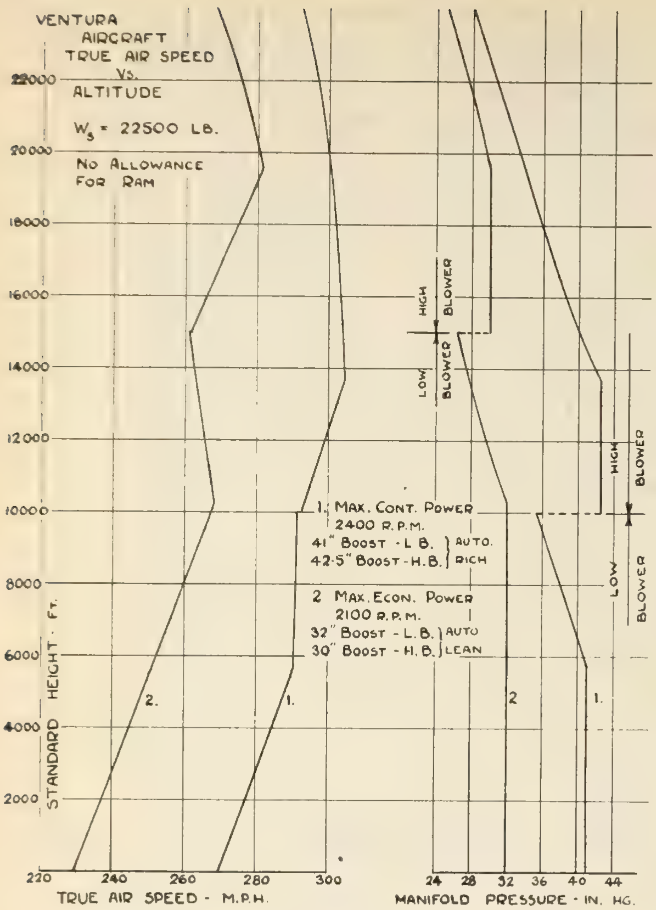

Fig. 5.

at low speeds (of the order of ten minutes) owing to the flat shape of the speed versus power curve where a small increase in power results in a large increase in speed and considerable time is required for the small increase in thrust to accelerate the aircraft to the equilibrium speed (and vice versa). The major portion of the speed and power curve can be obtained by flight tests at high altitude using as low a gross weight as possible. A few high power tests will need to be made at low altitude and low weight in order to extend the curve as far as possible at the high speed end. In the conduct of the level speed tests it is advisable to do the first few tests over as wide a range of engine powers and altitudes as possible, in order to check the relative accuracy of the powers as given by the power chart. If the experimental points so obtained yield a smooth curve of power versus speed after reduction of the results, this can be taken as confirmation of the relative accuracy of powers derived from the chart. Even if the chart is not accurate in this respect, it is still possible to obtain finally a correct curve of level speed versus altitude, for any given engine operating condition, provided that speed versus chart-power curves are derived at several representative altitudes.

If, during the A.S.I. position error determination, observations are made of the engine instruments, the results can be used together with tests at altitude for deducing the level speed characteristics of the aircraft.

Observations are made of the following quantities:

Time (for subsequent use in estimating weight of aircraft); Height (I.C.A.N. altimeter reading. Set initially at 29.92 in. or 1013.2 millibars); A.S.I. reading (equilibrium speed); Outside air temperature (for determination of relative air density); Carburettor air temperature (for correction of engine power given by charts); R.P.M. setting; Manifold pressure; Total fuel consumed during the flight tests.

The A.S.I. reading is corrected for instrument error and for position error, thus yielding the value of $\sqrt{\sigma}V$, the true indicated air speed (equivalent air speed).

The altimeter reading is corrected for instrument error and position error. The outside air temperature should be measured at low air speed (less than 100 m.p.h.) to eliminate error due to adiabatic heating, and care should be taken that the thermometer is not subjected to the effects of engine heat, sunshine or slipstream.

From the corrected altimeter readings and the outside air temperature, $\sqrt{\sigma}$ can be read directly from charts available for this purpose. From the corrected altimeter readings, the R.P.M. and manifold pressure indications, the engine B.H.P. can be read from the power curves. This power is then corrected for departure from the standard air temperature at the appropriate altitude by adding 1 per cent to the H.P. for every 10 deg. F. of temperature deviation below standard temperature and subtracting 1 per cent for every 10 deg. F. above standard temperature.

Having estimated the weight W of the aircraft for each test point from the time and total fuel consumed, the ratio W/W_s is calculated.

Hence for each test point $$V_{iw} = \frac{\sqrt{\sigma}\,V}{(W/W_s)^{1/2}}$$

and $$P_{iw} = \frac{\sqrt{\sigma}\,P}{(W/W_s)^{3/2}}$$

can be computed and plotted on the speed-power curve for sea level standard atmosphere at the chosen standard weight W_s. It should be noted that while the engine powers P must be multiplied by the value of $\sqrt{\sigma}$ deduced above, the A.S.I. readings when corrected for instrument and position errors give $\sqrt{\sigma}V$ directly.

Partial climb tests are made over as wide a speed range as possible, making sure that the lowest air speed is definitely well below the probable best climbing speed. Each set of partial climbs is carried out at constant power at air speed intervals of 10 m.p.h. Sufficient sets of tests are made to cover as wide a range of engine powers as possible. Cooling gills or radiator shutters should be wide open. At least one set of climbs is made at low altitude and high power and at as low a weight as possible, in order to achieve a high value of P_{iw}. In order to reduce the effect of wind gradient, the tests are preferably made under still air conditions. If this is not possible, the tests are carried out at right angles to the wind direction and two climbs are made at each

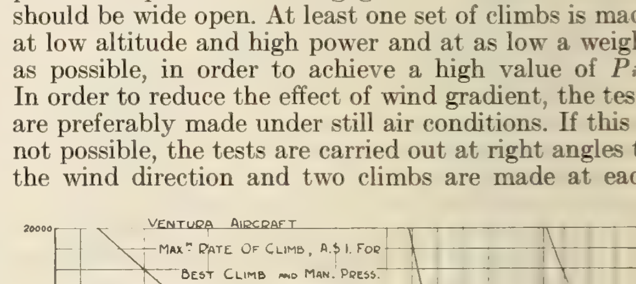

Fig. 6.

air speed, on reciprocal courses, the rate of climb then being taken as the mean of the two values measured. Rough air or cloudy conditions are liable to completely spoil the tests and, again, a great deal of the accuracy obtained will depend on the skill and experience of the pilot.

Each climb is started well below the lowest altitude of the height range through which the aircraft is timed, depending on the rate of climb, in order to ensure steady climbing conditions during the test. Thus, it is usual to start the climb some 500 to 1,000 ft. lower than the test altitude range. The pilot adjusts the R.P.M. to the required value and sets the throttles to give the required boost, maintaining the desired A.S.I. reading within ± 1 m.p.h. The aircraft is timed (by calibrated stop watch) during a climb of 1,000 ft. (by I.C.A.N. altimeter), the throttles being opened smoothly and continuously to maintain the boost reading during the climb. The results are assumed to apply at the mid point of the 1,000 ft. height range. At very low rates of climb it is customary to change the procedure and to climb for a period of three minutes, recording the altitude at every half minute (or more frequently). The results are then plotted and any errors due to atmospheric disturbance are immediately obvious and can be eliminated. With very high performance aircraft it might be necessary to time the aircraft for a 2,000 ft. climb and to commence the climb some few thousand feet below the starting height.

The following quantities are observed: Time (for estimation of weight); Height range of climb; A.S.I. reading; Time to climb through the height range; Outside air temperature at the mean height of the range; Carburettor air temperature; R.P.M. setting; Manifold pressure; Total fuel consumed during the flight tests.

The A.S.I. reading is corrected for instrument and position errors, thus yielding the value of $\sqrt{\sigma}V$, the true indicated or equivalent air speed. The mean point of the altitude range, as given by the altimeter, is corrected for instrument and position error. The outside air temperature reading is corrected for instrument error. From the corrected altitude and outside air temperature corresponding to the midpoint of the range, $\sqrt{\sigma}$ is read from a standard altitude correction chart, as in the level speed tests. The rates of climb (I.C.A.N.) are deduced from the height, range and time and the mean value is calculated for reciprocal climbs. Now, since the altimeter only registers real heights in a standard atmosphere, it follows that the real rate of climb will differ from the I.C.A.N. altimeter rate of climb if the atmosphere is non-standard and a

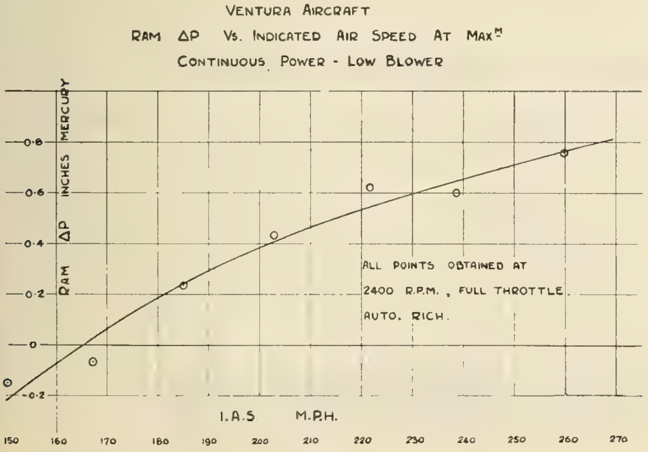

Fig. 7.

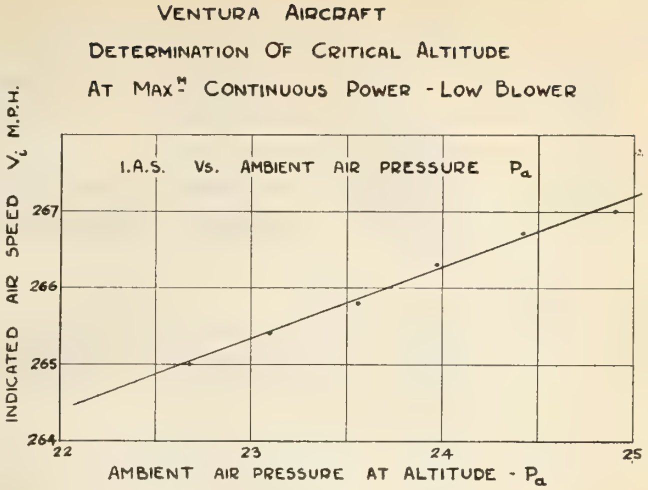

Fig. 8.

correction must be applied. Decrease of pressure with height is due to the weight of air between the two levels at which pressures are measured.

If H is true height in feet, $dH = \frac{\sigma_s}{\sigma} \cdot dh$

$$\therefore \frac{dH}{dt} = \frac{\sigma_s}{\sigma} \cdot \frac{dh}{dt} = \frac{T}{T_s} \cdot \frac{dh}{dt}$$

Hence true rate of climb is obtained from the rate given by the altimeter by multiplying by the ratio of the absolute air temperature at the mid-point of the range to the standard absolute air temperature at the same height. $\sqrt{\sigma}C$ is then calculated by multiplying the true rate of climb by $\sqrt{\sigma}$, and having estimated the weight at the time of test the following quantities are deduced:

$$V_{iw} = \frac{\sqrt{\sigma}V}{(W/W_s)^{1/2}}$$

$$C_{iw} = \frac{\sqrt{\sigma}C}{(W/W_s)^{1/2}}$$

$$P_{iw} = \frac{\sqrt{\sigma}P}{(W/W_s)^{3/2}} \qquad N_{iw} = \frac{\sqrt{\sigma}N}{(W/W_s)^{1/2}}$$

P is determined, as in the level speed tests, from R.P.M., boost, altitude and carburettor air temperature, using engine power charts.

A family of climb curves, giving rate of climb C_{iw} versus air speed V_{iw} for standard sea level conditions at various values of P_{iw}, is thus derived. In general, it will be found that, due to changes in weight and other conditions, the values of P_{iw} for a given set of climbs vary slightly. Since tests have, however, been conducted over a wide range of values of P_{iw}, cross-plotting C_{iw} versus P_{iw} at constant V_{iw} enables correction of each point to a chosen mean value of P_{iw}. Likewise, the curves should be corrected to constant N_{iw}, since it will be found that slight changes occur in the values of N_{iw} for a given set of climbs. The effect of variation in N_{iw} at constant P_{iw} causes a very slight variation in propulsive efficiency which can be approximated from the results of propeller tests for the same or similar installations. The correction is, in any case, quite small.

Single-engine partial climb tests are carried out in a similar fashion. In general, due to the low rate of climb, the heights are recorded at definite time intervals during a three-minute climb, rather than attempting to time a 1,000 ft. climb. The propeller on the dead engine is placed in the full coarse pitch position (or feathered), the throttle closed and the mixture control lever in the idle cut-off position. Cooling gills or radiator shutters are fully open on the working engine and fully closed

TABLE III

Calculation of Level Speeds at Altitude (Standard Atmosphere) Neglecting Ram Pressure

Altitude Feet	Blower Setting	$\sqrt{\sigma}$	Maximum Continuous Power 2400 R.P.M.					Maximum Economical Power 2100 R.P.M.				
			BHP	P_{iw}	V_{iw}	V True M.P.H.	Boost	BHP	P_{iw}	V_{iw}	V True M.P.H.	Boost
0	Low	1.000	3010	3010	270.0	270.0	41.0	1875	1875	229.3	229.3	32.0
1000	"	.985	3040	2996	269.6	273.7	41.0	1915	1885	229.7	233.1	32.0
2000	"	.971	3060	2972	269.0	277.0	41.0	1960	1903	230.0	236.9	32.0
3000	"	.957	3090	2958	268.5	280.6	41.0	1990	1904	230.0	237.9	32.0
4000	"	.943	3120	2942	268.0	284.2	41.0	2030	1914	230.5	244.4	32.0
5000	"	.929	3140	2918	267.3	287.9	41.0	2070	1923	231.2	249.0	32.0
5700	"	.918	3160	2902	266.7	290.4	41.0	—	—	—	—	—
6000	"	.915	3140	2875	265.8	290.4	40.7	2100	1921	231.0	252.4	32.0
7000	"	.900	3050	2746	261.5	290.6	39.2	2130	1916	230.6	256.2	32.0
8000	"	.886	2970	2632	257.5	290.7	37.8	2165	1918	230.8	260.4	32.0
9000	"	.873	2880	2516	254.0	291.0	36.6	2195	1915	230.5	264.0	32.0
10000	"	.860	2800	2410	250.3	291.1	35.3	2200	1892	229.8	267.1	31.8
11000	"	.846	2710	2292	246.0	290.8	34.1	2125	1798	225.5	266.5	30.8
12000	"	.832	2620	2180	241.5	290.2	33.0	2040	1697	220.5	265.0	29.7
13000	"	.820	2540	2082	238.0	290.2	31.7	1970	1615	216.4	264.0	28.5
14000	"	.806	2450	1975	233.5	289.8	30.6	1900	1531	211.5	262.3	27.4
15000	"	.793	2360	1872	229.0	288.9	29.5	1830	1452	207.0	261.0	26.3
16000	"	.780	2275	1774	224.5	287.9	28.3	1760	1373	202.0	259.0	25.4
17000	"	.767	2185	1676	219.5	286.1	27.3	1700	1304	197.5	257.5	24.4
10000	High	.860	2850	2450	251.7	292.6	42.5	—	—	—	—	—
11000	"	.846	2853	2413	250.3	296.0	42.5	—	—	—	—	—
12000	"	.832	2856	2375	249.3	299.7	42.5	—	—	—	—	—
13000	"	.820	2860	2344	248.0	302.5	42.5	1790	1468	208.0	254.0	30.0
14000	"	.806	2820	2272	245.2	304.2	41.7	1820	1467	208.0	258.2	30.0
15000	"	.793	2710	2148	240.5	303.3	40.0	1845	1464	207.5	261.8	30.0
16000	"	.780	2620	2044	236.5	303.3	38.5	1875	1463	207.4	266.0	30.0
17000	"	.767	2530	1942	232.0	302.5	37.2	1900	1457	207.3	270.3	30.0
18000	"	.755	2440	1843	227.5	301.3	35.9	1930	1456	207.3	274.6	30.0
19000	"	.742	2350	1744	223.0	300.5	34.5	1955	1452	207.1	279.0	30.0
20000	"	.730	2270	1658	218.5	299.2	33.2	1930	1409	204.5	280.1	30.0
21000	"	.717	2190	1570	214.0	298.5	31.9	1850	1327	199.5	278.3	28.7
22000	"	.705	2116	1492	209.5	297.1	30.7	1770	1250	194.0	275.1	27.5
23000	"	.693	2030	1407	204.3	295.0	29.5	1700	1180	188.7	272.4	26.4
24000	"	.682	1956	1334	199.5	292.5	28.1	1630	1112	183.0	268.3	25.2
25000	"	.670	1876	1257	194.5	290.2	27.0	1560	1045	177.5	265.0	23.8
26000	"	.658	1804	1187	189.5	288.0	25.8	1495	983	172.0	261.4	22.9

Engine Rating	R.P.M.	Man. Press. Inches	Mixture	B.H.P.	Crit. Alt. Ft.	Blower
Take-off	2700	52	Auto. R.	2000	—	Low
Military Maximum	2700	47	Auto. R.	1600	12,000	High
Max. Continuous	2400	41	Auto. R.	1575	5,700	Low
Max. Continuous	2400	42½	Auto. R.	1430	13,700	High
Max. Economical	2100	32	Auto. L.	1080	10,300	Low
Max. Economical	2100	30	Auto. L.	960	20,000	High

on the dead engine. The test method and reduction of results follows the same scheme as for the symmetrical power case. Single engine tests are even more exacting and tiring on the pilot. Climbs are alternately made on port and starboard engines to prevent excessive cooling of one engine and excessive heating of the other.

From the symmetrical power climb curves, a single curve of maximum C_{iw} versus P_{iw} can be plotted. The speed V_{iw} for maximum climb is also deduced.

Example

The tables and charts included in this article are for the purpose of illustrating the "iw" method of performance testing and reduction. It will be appreciated that these do not cover the complete performance testing, only sufficient tests being included to indicate the method used.

Aircraft — Ventura
Engines — P. and W. R. 2800—31 (2 SBG)
Standard weight — W_s = 22,500 lb.

Derivation of Performance at Altitude in the Standard Atmosphere

As mentioned earlier, the performance at altitude in the standard atmosphere is deduced from the level speed and climb data (V_{iw}, C_{iw}, P_{iw}) which has been derived for sea level standard conditions.

In general, the variation of true level speed with height is required for given engine operating conditions (e.g. maximum continuous power or maximum economical power) and the variation of rate of climb with height is required for some given engine operating condition (e.g. maximum continuous power). In computing this information at each altitude under consideration, the engine power P developed at the given operating condition is read from the engine power charts and the appropriate value of P_{iw} is determined by multiplying by $\sqrt{\sigma}$. It is not necessary to divide by $(W/W_s)^{3/2}$, since in this case W is assumed to be equal to W_s. The P_{iw}, V_{iw} curve and the maximum C_{iw}, P_{iw} curve then give the values of V_{iw} in level flight and maximum indicated rate of climb C_{iw}, from which true level speed and maximum rate of climb are obtained by dividing by $\sqrt{\sigma}$.

This process is quite straightforward for the climb performance where the forward speed is low and the effects of ram pressure are negligible. However, in the case of level speeds, ram pressure at the carburettor, obtained as a result of the carburettor air intake scoop being faced into the slipstream so as to gain the supercharging effect equivalent to the velocity pressure of the air stream, raises the altitude at which the manifold pressure is just obtained at full throttle (critical altitude). Hence, for level speeds above the critical altitude, if the power curves are used with no allowance for ram, the performance in level flight is underestimated and it is desirable to introduce a correction for ram pressure which increases both the critical altitude and the level speed obtainable above the critical altitude for a given engine operating condition.

If the losses in the induction system are appreciable, it may be that at the speed for best climb a "negative ram" effect is present and the critical altitude may actually be less than is indicated by the power charts. In such cases, the climb performance curves derived from the test data may be corrected for this effect by a method analogous to that given below for ram effects on level speed performance.

Determination of Critical Altitude

The following method for the determination of critical altitude is given, using the maximum continuous power condition (2400 R.P.M. and 41 in. manifold pressure) in low blower for the Ventura aircraft, as an example.

Symbols

Let P_a = atmospheric pressure (in inches of mercury). From altimeter reading.

P_{ie} = blower impeller entrance pressure (inches of mercury). This necessitates the fitting of a static pressure line to measure the pressure at the impeller entrance. A standard manifold pressure gauge can be used, connected by a line to the carburettor adapter (between the throttle and the supercharger impeller inlet).

P_b = boost pressure (inches of mercury)

r = blower compression ratio P_b/P_{ie}

I.A.S. = indicated air speed (M.P.H.)

$\triangle P$ = ram = $P_{ie} - P_a$ (in inches of mercury)

Theory

There is a loss in head due to resistance to flow through the carburettor and through the ducting between the air intake and the impeller entrance. When stationary on the ground, therefore, with the engine running, the impeller entrance pressure P_{ie} is less than the surrounding air pressure P_a. As the forward speed increases, the impeller entrance pressure is increased by "ramming" until, at sufficiently high speeds, P_{ie} is greater than the ambient air pressure P_a, by an amount $\triangle P$.

$\triangle P = P_{ie} - P_a$ can be plotted against I.A.S. for full throttle flight, by measuring P_{ie} and P_a at various I.A.S.

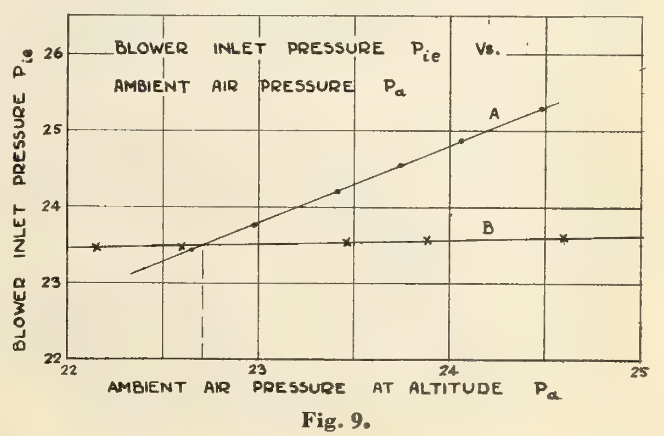

Fig. 9.

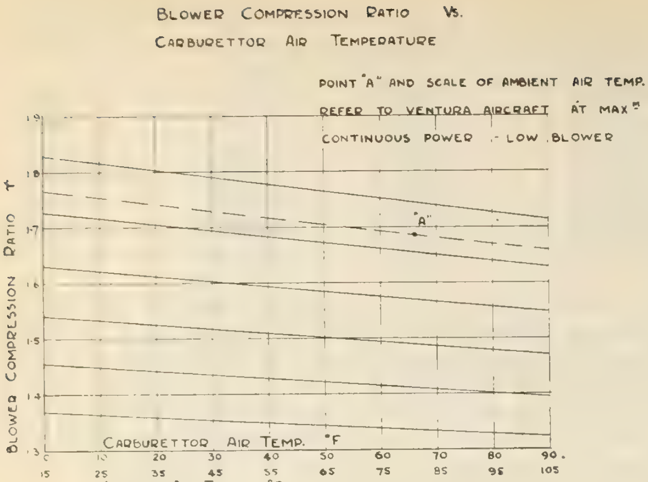

Fig. 10.

values (see Fig. 7). Level flight gives one I.A.S. value; other values are obtained by climbing and diving the aircraft.

From the P_{iw}, V_{iw} relationship, a graph can be constructed (see Fig. 8), giving the I.A.S. for level flight versus altitude and hence versus P_a the air pressure at altitude, for the particular engine operating conditions for which the critical altitude is required. P_{iw} is calculated from the altitude and engine operating conditions and the corresponding value of V_{iw} is then obtained from the P_{iw}, V_{iw} curve; hence for $W = W_s$, $V_{iw} = V_i$ the I.A.S. In constructing this graph of I.A.S. versus P_a, no critical altitude is assumed and the engines are considered to have a uniformly increasing power from sea level. The point at which the engine power begins to decrease (the critical altitude) is yet to be determined.

From the two charts of I.A.S. versus P_a and $\triangle P$ versus I.A.S., it follows that $\triangle P$ versus P_a can be deduced and hence we can plot P_{ie} ($= \triangle P + P_a$) versus P_a. This is shown in Fig. 9, line A. This chart shows the impeller entrance pressure which would be obtained in level, full throttle flight of the Ventura aircraft at maximum continuous power, low blower, plotted against altitude (given in terms of air pressure P_a), assuming that the manifold pressure corresponding to maximum continuous power can be obtained at all altitudes (no critical altitude). Now at the critical altitude, the impeller entrance pressure in level flight is only just able to provide the required boost, and above the critical altitude the impeller entrance pressure is inadequate. It is therefore necessary to determine the value of P_{ie} required to give the stated boost P_b.

The blower compression ratio r is a function of carburettor air temperature, decreasing slightly as the temperature increases. Curves showing this variation are available in the literature and have been reproduced in Fig. 10. It remains to determine the appropriate curve for the Ventura aircraft at the stated engine operating conditions.

From a level speed test conducted slightly below the probable critical altitude, at the required R.P.M. (2400) and full open throttle, the following readings were taken:

Carburettor air temperature	=	+66°F.
Outside air temperature	=	+81°F.
Altitude = 6300 ft. Hence P_a	=	24.0 in. of mercury
Boost P_b	=	41.5 in. of mercury
Impeller inlet pressure P_{ie}	=	24.6 in. of mercury
Hence ram $\triangle P = P_{ie} - P_a$	=	0.6 in. of mercury
and compression ratio r	=	$\frac{P_b}{P_{ie}} = 1.686$

This value of r is then plotted on the chart (Fig. 10) of r versus carburettor air temperature, giving point "A", and through "A" a dashed line is constructed, which fits in with the existing lines on the chart. This line then gives the value of r versus carburettor air temperature for the required R.P.M. (2400). Knowing the difference between the carburettor air temperature and the outside air temperature ($66° - 81° = -15$°F.) and assuming carburettor air temperature to have a constant difference from outside air temperature, a scale of outside air temperature can be added below that of carburettor air temperature, giving us a relationship between r and outside air temperature. Hence for any desired boost P_b we can plot P_{ie} ($= P_b/r$) against outside air temperature or against P_a, the atmospheric pressure in the standard atmosphere, at the altitude giving these temperatures. This has been done in Fig. 9, line B. This line shows the impeller entrance pressure which is required to produce the specified boost (41 in.) at 2400 R.P.M. The intersection of the two lines A and B gives the P_a value corresponding to the critical altitude for the chosen engine conditions. For the example chosen, $P_a = 22.71$ in., corresponding to a critical altitude of 7,450 ft. At greater heights (lower P_a values) the impeller entrance pressure which is required to yield a boost of 41 in. is greater than the impeller entrance pressure provided in full throttle level flight at the given engine operating conditions. It follows therefore that the boost pressure will fall, as expected, above the critical altitude.

A similar treatment is used for the determination of critical altitude at maximum economical power (2100 R.P.M. and 32 in. boost) in level flight. In this case, a critical altitude of 11,850 ft. is obtained, for low blower operation.

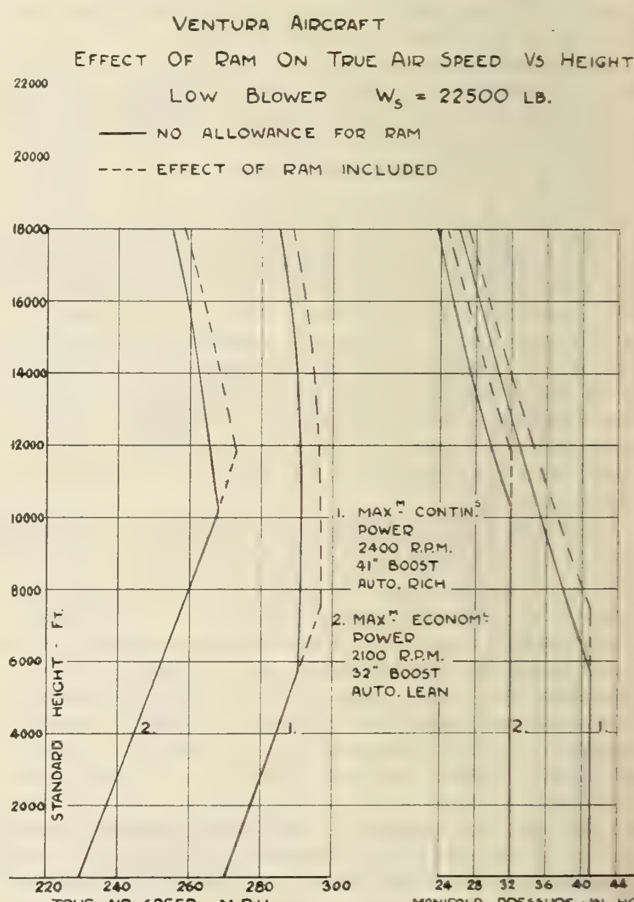

Fig. 11.

The determination of critical altitude in high blower for maximum continuous and maximum economical operation can be deduced in a similar fashion.

The approximate shape of the level speed versus altitude curves above the critical altitude is obtained by determining at what altitude the ram $\triangle P = 0$ (From the curve of $\triangle P$ versus I.A.S. and a plot of I.A.S. versus altitude with no allowance for ram) since, at this altitude, the curves of I.A.S. versus altitude for (a) no allowance for ram and (b) allowance for ram, will intersect.

The level speed versus altitude curves for the Ventura aircraft at maximum continuous and maximum economical power, in both low and high blower, but with no allowance for ram are shown in Fig. 5. The effect of ram on critical altitude, in low blower, is shown in Fig. 11.

The twin-engine climb data plotted against altitude is given in Fig. 6.

Tables have been included in this report showing the various steps in the calculations necessary for the preparation of the above charts.

The "iw" method of performance testing and reduction has other useful applications, such as, the determination of the correct propeller pitch settings to give prescribed engine operation limits under any specified condition. An example of the application of the "iw" method to such a problem will now be given.

Considerable variation was found to exist in the pitch settings that were being used for Hoover two-position propellers on Anson II aircraft. It was found in many cases that the coarse pitch settings resulted in too high a boost when cruising at the recommended cruising R.P.M. at low altitudes or on cold days. It had been suggested that recurrent failure of cylinder heads on Jacobs engines may have been due to exceeding the maximum boost of 20 in. when cruising at the manufacturer's recommended limits of 20 in. boost at 1900 R.P.M.

The "iw" method was to be used to determine the correct pitch settings for both 8 ft. diameter and 7 ft. 6 in. diameter Hoover two-position propellers. The required pitch settings were to give:—

(a) 2200 R.P.M. when climbing at the optimum twin-engine climbing speed at full throttle at sea level (I.C.A.N. standard atmosphere), propellers in fine pitch.

(b) 1900 R.P.M. and 20 inches manifold pressure simultaneously in level cruising flight, at sea level atmospheric pressure but at air temperature of 0°F., propellers in coarse pitch.

The methods of test and results for the 8 ft. diameter propeller only are given below; similar methods were used for the 7 ft. 6 in. propeller.

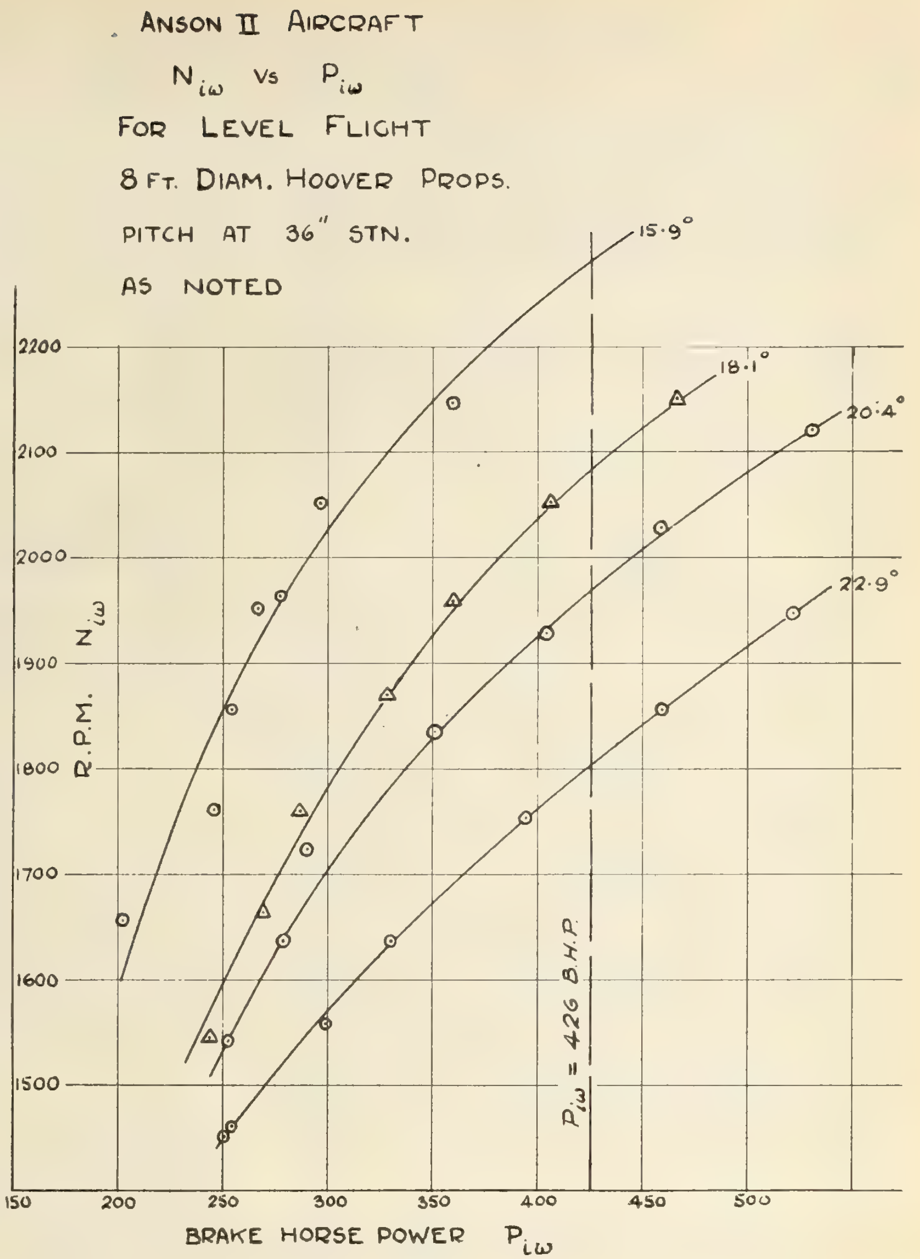

Fig. 12.

Coarse Pitch Setting

A series of level speed tests were carried out at pitch settings of 15.9 deg., 18.1 deg., 20.4 deg. and 22.9 deg. (at the 36 in. station). From the experimental results, curves of R.P.M. (N_{iw}) were plotted against brake horsepower (P_{iw}) for sea level in the standard atmosphere.

Now the B.H.P. developed by two engines at 1900 R.P.M. and 20 in. of boost, at sea level standard atmospheric pressure and temperature (29.92 in. of mercury and 59 deg. F.) is given as 380 B.H.P. by the manufacturer's power chart. Assuming the carburettor air temperature to be the same as the required outside air temperature of 0 deg. F., the B.H.P. corrected for a difference of 59 deg. F. at sea level pressure will be:—

$$380 \times 1.059 = 402.5 \text{ B.H.P.}$$

$\sqrt{\sigma}$ for sea level pressure and 0°F. (−18°C.) air temperature is 1.059.

Hence

$P_{iw} = \sqrt{\sigma}P = 1.059 \times 402.5 = 426$ B.H.P. and $N_{iw} = \sqrt{\sigma}N = 1.059 \times 1900 = 2010$ R.P.M. $\Big\}$ for $W = W_s = 8000$ lb.

From the curves of N_{iw} versus P_{iw} (Fig. 12) for the experimental pitch settings, values of N_{iw} at the required P_{iw} of 426 B.H.P. are read off and plotted against pitch setting (Fig. 14). From the curve thus obtained, the correct pitch setting, which would give the desired N_{iw} of 2010 R.P.M., is deduced immediately.

Fine Pitch Setting

A series of twin-engine partial climb tests at various power settings were carried out at the best climbing speed of 89 m.p.h. A.S.I. for each of three pitch settings. The best climbing speed was obtained from the Pilots' Handling Notes for Anson II aircraft. The experimental pitch settings used were 15.9 deg, 18.1 deg. and 20.4 deg.

From the experimental results, curves of R.P.M. (N_{iw}) were plotted against brake horsepower (P_{iw}) for sea level standard atmosphere (Fig. 13).

Now the B.H.P. developed by two engines at full throttle (2200 R.P.M. and 27 in. boost) at sea level in the standard I.C.A.N. atmosphere is given as 660 B.H.P. by the engine manufacturer's power chart. Assuming the carburettor air temperature to be equal to the outside air temperature of 59 deg. F. (the standard sea level air temperature), no correction for carburettor air temperature is necessary. Also $\sqrt{\sigma}$ is 1.0 for standard I.C.A.N. sea level conditions.

Hence $P_{iw} = 660$ B.H.P. and $N_{iw} = 2200$ R.P.M. $\Big\}$ for $W = W_s = 8000$ lb.

From the curves of N_{iw} versus P_{iw} (Fig. 13) for the experimental pitch settings, values of N_{iw} at the required P_{iw} of 660 B.H.P. are read off and plotted against pitch setting (Fig. 14). From the curve thus obtained, the correct pitch setting which would give the desired N_{iw} of 2200 R.P.M. is deduced immediately.

It will be seen from Fig. 14 that a fine pitch setting of 16.4 deg. and a coarse pitch setting of 19.4 deg., measured at the 36 in. station, will enable the specified engine operating conditions to be obtained.

Performance Analysis

The "iw" method of performance testing and reduction lends itself very readily to the analysis of aircraft performance, as indicated in the following paragraphs.

Propeller Efficiency

If, from the climb test results (Fig. 3), C_{iw} is plotted as a function of P_{iw} at constant V_{iw}, a curve similar to

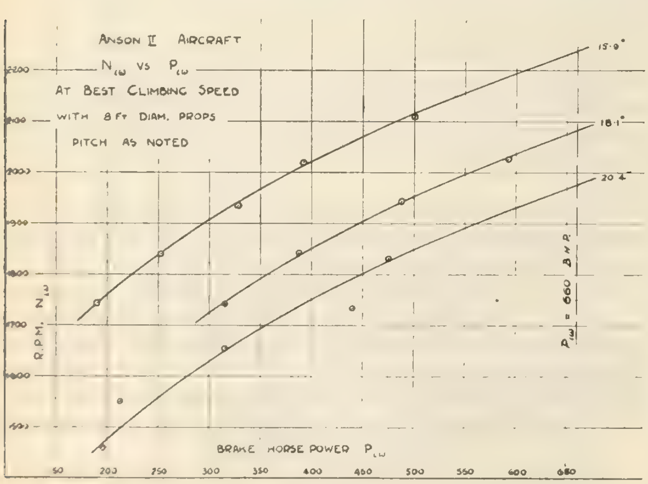

Fig. 13.

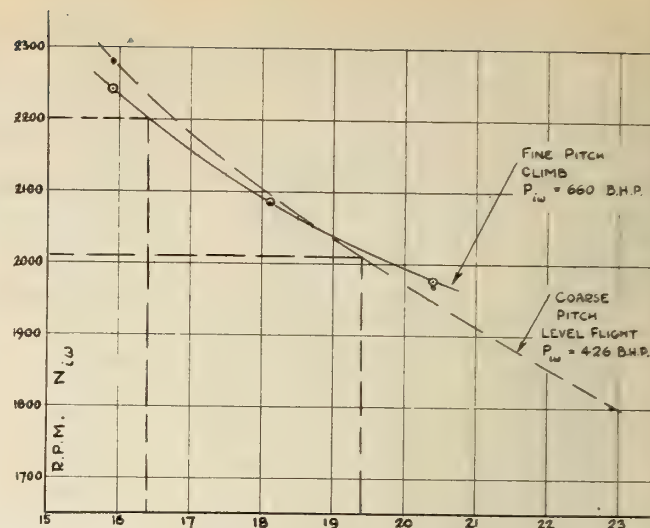

Fig. 14—Anson II Aircraft. N_{iw} vs. Propeller pitch. At 36" Station. Hoover. 8 ft. diam. Two position drops.

that of Fig. 4 is obtained. (The curve of Fig. 4 gives the maximum rate of climb, for which V_{iw} is not constant). Now it can be shown that—

$$\eta_a \cdot P_{iw_a} = W_s \cdot C_{iw} + \eta \cdot P_{iw} \qquad (5)$$

Where P_{iw_a} = Total engine power available under climb conditions, at speed V_{iw}.

η_a = Corresponding propeller efficiency in the climb.

P_{iw} = Engine power required for level flight at speed V_{iw}.

η = Corresponding propeller efficiency in level flight.

C_{iw} = Rate of climb at speed V_{iw} and power P_{iw_a}.

Now as C_{iw} becomes small and P_{iw_a} approaches P_{iw}, the value of η_a will approach that of η. Substituting for η_a,

$$\eta(P_{iw_a} - P_{iw}) = W_s \cdot C_{iw}$$

$$\text{or } \eta = W_s \cdot \frac{C_{iw}}{(P_{iw_a} - P_{iw})} \qquad (6)$$

The value of P_{iw} in this expression is given by the intercept of the C_{iw}, P_{iw} curve on the P_{iw} axis ($C_{iw} = 0$). Hence the propeller efficiency for level flight at any speed V_{iw} is given by the product of the standard weight W_s and the slope of the corresponding C_{iw}, P_{iw} curve where this crosses the P_{iw} axis. (Note P_{iw} values are converted from H.P. to ft. lb./min. values when measuring this slope).

Knowing P_{iw} and η, equation 5 will then yield the propeller efficiency in the climb (η_a) at the same speed V_{iw} and engine power P_{iw_a} producing a rate of climb C_{iw}.

It will be seen that the relative efficiencies of two different propellers, under any operating condition, on a given type of aircraft can be readily determined by this method. If a torquemeter is used, allowing accurate power measurement, segments of C_{iw}, P_{iw} curves can be obtained over the whole level flight range of V_{iw} and precise values of propeller efficiency can be deduced, enabling the total drag of the aircraft to be estimated with considerable accuracy.

Range and Cruising Control

If a tangent be drawn from the origin ($V_{iw} = 0$, $P_{iw} = 0$) to a P_{iw}, V_{iw} curve, the slope of this tangent determines the maximum value of the ratio of miles per hour to brake horse power. Assuming that fuel consumption in gallons per hour is directly proportional to brake horse power output, then the slope of the tangent determines the maximum value of the ratio:—

TABLE IV

CALCULATION OF RATE OF CLIMB AT ALTITUDE (STANDARD ATMOSPHERE) AT MAXIMUM CONTINUOUS POWER

Altitude Feet	Blower Setting	$\sqrt{\sigma}$	P_{iw}	C_{iw}	Rate of Climb C ft./min.	V_{iw} M.P.H.	A.S.I. M.P.H.
0	low	1.000	3010	1965	1965	149.3	140.2
1000	"	.985	2996	1950	1980	—	—
2000	"	.971	2972	1930	1987	149.0	139.8
3000	"	.957	2958	1920	1986	—	—
4000	"	.943	2942	1905	2020	148.8	139.6
5000	"	.929	2918	1880	2023	148.7	139.5
5700	"	.918	2902	1870	2038	148.5	139.2
6000	"	.915	2875	1845	2016	148.3	139.0
7000	"	.900	2746	1735	1928	147.5	138.0
8000	"	.886	2632	1630	1840	146.6	137.0
9000	"	.873	2516	1535	1758	145.8	136.4
10000	"	.860	2410	1440	1675	145.1	135.5
11000	high	.846	2415	1445	1708	145.2	135.6
12000	"	.832	2377	1410	1695	145.0	135.2
13000	"	.820	2347	1385	1689	144.8	135.0
14000	"	.806	2273	1315	1632	144.3	134.5
15000	"	.793	2150	1210	1526	143.4	133.4
16000	"	.780	2044	1120	1436	142.7	132.6
17000	"	.767	1942	1030	1343	142.1	132.0
18000	"	.755	1843	945	1252	141.4	131.0
19000	"	.742	1744	860	1158	140.7	130.0

$$\frac{\text{miles/hour}}{\text{gals./hour}} = \frac{\text{miles}}{\text{gal.}}$$

Hence, the tangent point on the P_{iw}, V_{iw} curve determines the speed V_{iw} for maximum range. The assumption that fuel consumption is directly proportional to power output is applicable in those cases where it is not necessary to exceed maximum weak mixture cruising power to maintain the speed V_{iw} determined by the tangent. This means that the method is applicable to all but a very few cases, such as, cruising at high altitudes and high gross weights.

The standard type of cruising control chart can be readily constructed from the P_{iw}, V_{iw} curve and an engine consumption chart in the form of gallons/hour as a function of brake horse power, each line representing a specific constant R.P.M. value. If consumption at constant B.H.P. is a function of altitude, each line of this latter chart will become a family of lines for the same R.P.M. but different altitudes.

The consumption characteristics should be determined from flight tests of the aircraft for which the cruising control chart is being constructed. It will be readily apparent that a proper flight plan will permit the simultaneous determination of the data required for the P_{iw}, V_{iw} curves and the fuel consumption curves in a reasonably short period of test flying (five or six hours). It will then be possible to construct cruising control charts or tables showing:—Gross weight; Optimum I.A.S. for best range at that weight; True air speed corresponding to optimum I.A.S. at any altitude; Corresponding B.H.P. required; Optimum R.P.M. at which to draw the required B.H.P. from the engines (considering all factors); Consumption in gals./hour; Optimum miles per gallon.

EFFECT OF AIRFRAME CHANGES

It is often necessary to estimate the effect on the performance of an aircraft, of airframe changes, when little is known of the aerodynamic characteristics of that particular aircraft. When this is the case, the "iw" method proves especially useful in assessing and analyzing such data as are available from different sources. This data may be performance estimates, wind tunnel data or flight test results and will usually be characteristic of a large range of gross weights. If this data is plotted on a P_{iw}, V_{iw} basis, there will often be considerable scatter of the points. Some of this scatter can be eliminated frequently by discounting the highest performance points (probably representing the manufacturer's performance estimate) but considerable difficulty will still remain in locating the P_{iw}, V_{iw} curve through the remaining points.

In this case a curve is first drawn by eye and cross fairing is employed, based on the assumption that within the working range of lift coefficients (0.3 to 1.0) the drag polar can be represented by the parabolic relation—

$$C_D = C_{D_p} + \frac{C_L^2}{\pi\, e\, AR}$$

If this is done it will be necessary, from the trial P_{iw}, V_{iw} curve, to calculate successively:—

P_{iw}

V_{iw}

η (from propeller charts), hence $\text{T.H.P.}_{iw} = \eta \cdot P_{iw}$

$q = \frac{1}{2}\rho V^2 \cdot$ (from V_{iw})

D (the drag of the aircraft, from $T.H.P._{iw}$)

C_D (from D, wing area and q)

C_L (from wing loading and q)

C_D is then plotted against C_L^2. Again, there may be considerable scatter. It will be noted, however, that the parabolic relation demands that C_D plotted against C_L^2 should yield a straight line of slope $\frac{1}{\pi\, e\, AR}$ with an intercept C_{D_p} on the C_D axis.

If the most reasonable straight line be drawn through the points on the C_D, C_L^2 chart and the calculation process reversed, a P_{iw}, V_{iw} curve will be obtained which satisfies the usual parabolic polar relation and at the same time is as compatible with the P_{iw}, V_{iw} points as the original assumed curve.

PERFORMANCE PREDICTION

The "iw" method can be used with convenience in analytical work during preliminary design calculations.

(Continued on page 783)

COLUMN FORMULA FOR MATERIALS OF VARIABLE MODULUS

Developed by the Theory of Limit Design①

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This is the second instalment of the material for an address on Evaluation of Light Metal Alloys to be delivered at the Sixtieth Annual General and Professional Meeting of The Engineering Institute of Canada, next February, in Montreal. Either oral discussion at the meeting or written discussion is invited.

This paper is the fourth of a series, all dealing with the subject of column analysis. Titles of the other papers of the series are given in references ②, ③ and ⑤. In the discussion④ of Rational Column Analysis, Mr. E. C. Hartmann of the Aluminum Company of America, and Mr. F. R. Shanley of the Lockheed Aircraft Corporation, called attention to the fact that the limit carrying capacity of columns made of material with a variable modulus of elasticity, such as aluminum or magnesium alloys, was not treated. In my closing discussion I replied that, possibly in the future, I might want to express myself on this matter. The present paper is an attempt to throw more light on the subject of variable modulus columns.

Eccentrically loaded 24 ST aluminum alloy extruded columns were tested, and a limit-strength, eccentrically loaded column formula, has been developed. This limit-strength formula, given later as formula 7, for rectangular extruded columns is primarily of academic interest. It becomes much more significant, however, when we show, as we believe we have done, that not only does it fit the experimental values for columns loaded with definite eccentricities, but that it also closely fits the experimental values—more closely than any other known formula—in cases in which the eccentricity is zero. For cases of zero eccentricity, it assumes a more general form as formula 8. It compares with the double modulus theory, and with the Engesser equation, $\frac{P}{A} = \frac{\pi^2 E'}{(l/i)^2}$. Up to the present I have felt the logic involved in the double modulus theory as unsound, and that the Engesser formula (Euler's formula with a variable E' instead of a constant E) was the best approach available to a theoretical prediction of limit column strength for columns of material with a variable E. It is now believed that formula 8 is rational and that it fits the experimental values as well, or better, than the Engesser formula does, and that it has the added advantage of being much easier to solve, and does not require a detailed and refined compression stress-strain curve for its solution, as does the Engesser formula.

Eccentrically Loaded, Variable Modulus, Column Theory

An eccentrically loaded column assumes a shape, roughly, as indicated in Fig. 1 (a). The eccentricity e is augmented by an eccentricity $\triangle$, the $\triangle$ resulting from the curvature of the column. If we know the values for e and $\triangle$, and also know the stress distribution over the cross section area of the column, we can solve for the load P. As to $\triangle$, we know that it is a function of the length and of the curvature of the column. Unfortunately, however, we know nothing definite about the curvature of a column composed of a varying modulus material and stressed far beyond the proportional limit throughout its length. But we do know from observation that the curvature does not assume the shape of two straight lines. We also know that a second degree equation can generally be fitted within close approximation to most any flat curve of single curvature. We therefore propose to assume that we may express $\triangle$ by the function $\triangle = kl^2$. It should be realized that the constant k, in turn, is a function of the eccentricity e.

As to the stress distribution over the cross-sectional area at the mid section of the column, we know that the compressive stress on the concave side of the column equals the upper yield point stress, here called S_2. For example: S_2 is 50,000 lb. per sq. in. for 24 ST, and 80,000 lb. per sq. in. for R 303 T, or 75 ST alloy. Further, we know, also from direct strain gauge measurements, that the tensile stresses on the convex side of the column, when the column supports its capacity load and when the tension stress-strain curve is the same as the compression stress-strain curve, likewise amount to this same stress S_2.

By upper yield point stress S_2 I mean an upper limit stress in which the stress-strain curve becomes nearly horizontal. As may be seen from Fig. 4 and from numerous stress-strain curves for aluminum and magnesium alloys in reference ⑤, the compression stress-strain curve never assumes a zero slope. After a certain strain value is reached it goes on rising, apparently indefinitely. In this connection it must be remembered that the stress-strain curves which I have presented, and which are generally presented, are not true stress-strain curves. When a strain of the order of magnitude of .010 is reached, the cross-section area becomes something quite different from what it was when loading commenced. A true stress-strain curve, based on a stress determined by the area which varies as a function of the load, rather than computed on the basis of original area, would thus have a much smaller slope. The conventional yield stress, defined by the 0.2% offset, is purely arbitrary, has no logical foundation, and thus cannot be used in any rational philosophy. For mild steel the upper yield stress S_2 is clearly defined.

From what we know of elementary limit design①, and residual stress analysis, the final stress distribution at the instant of failure, in case of identical tension and compression stress-strain curves, qualitatively looks something like Fig. 1 (b). We also know that if we simplify this sketch by giving it sharp corners and making it look like Fig. 1 (c), we introduce only a very minor error. The arrows, shown in Fig. 1 (d) as acting on the cross-section of the column, convey the same idea as that shown in Fig. 1 (c). The stresses shown on Fig. 1 (d) may be resolved into a Force $P = S_2A$ and a couple $S_2A_2(2X_1) = P(e+\triangle)$ as shown in Fig. 1 (e).

As to the eccentricity e I have already dwelt at great length on the subject to show that any column analysis based on eccentricity has no practical value, since, in practice, e can only be definitely ascertained at the end of a complete analysis. It is a variable, in fact, it generally changes its sign. It is intangible, and slippery as an eel's tail. Much vaunted "engineering judgment"

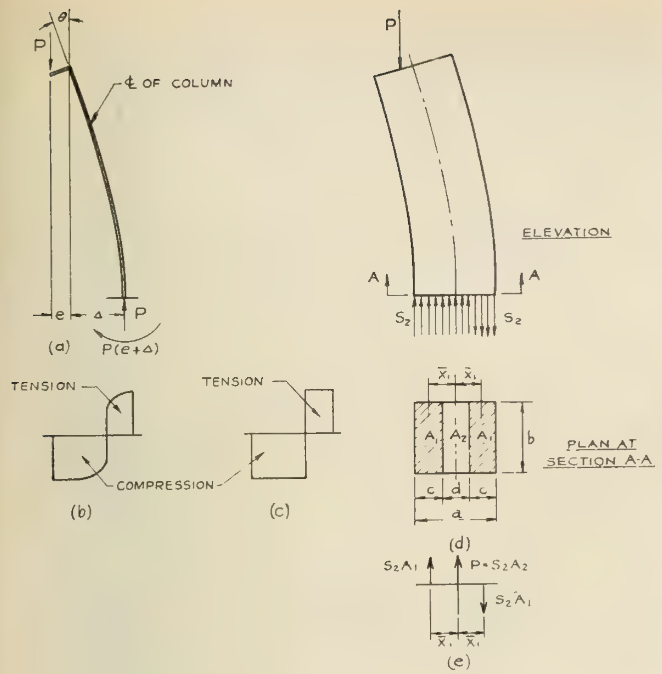

Fig. 1

notwithstanding, I believe that anyone who assumes, or any committee who prescribes, a definite value for $\frac{ec}{i_2}$ is making a stab in the dark, in the pitch dark.

Any eccentric column analysis, thus, holds only academic, even though great, interest. This statement of course applies with equal force to our present analysis. By suitable laboratory control we may design our test equipment for an initial value of e which will hold substantially constant throughout the loading range. As the column is loaded the tangent to the elastic curve at the top of the column deflects; and if e represents the initial eccentricity, then the eccentricity which prevails at the end of the loading process should be written: $e \times \cos\theta$. (See Fig. 1 a) This variation in the value of e is a minor issue. However, when we ignore it, as we propose to do, we do not entirely neglect it, since the variation in e may also be assumed as a function of kl^2. Thus this variation in e will largely be included in the evaluation of the constant k.

On the basis of the assumptions here set forth, we may proceed with a mathematical analysis. Writing the equilibrium equation for Fig. 1, we obtain:

$$2\,S_2A_1X_1 = P(e+\triangle) = P(e+kl^2)$$

$$S_2A_2 = P$$

$$A_2 = A-2A_1 = ab-2bc$$

$$2X_1 = a-c$$

$$S_2(bc)(a-c) = S_2(ab-2bc)(e+\triangle)$$

$$C^2 = \left\{a + 2\,(e+\triangle)\right\}c + a\,(e+\triangle) = 0$$

$$c = \frac{a+2(e+\triangle) - \sqrt{a^2+4(e+\triangle)^2}}{2}$$

$$d = a-2c + \sqrt{a^2+4(e+\triangle)^2} - 2(e+\triangle)$$

$$P/A = \frac{S_2bd}{ab} = \frac{S_2d}{a} = \frac{2S_2}{a}\left\{\sqrt{\frac{a_2}{4}+(e+kl^3)^2} - (e+kl^2)\right\}$$

Formula 7

Solving formula 7 for k and substituting particular values for P and l, say $P=P_1$ and $l=l_1$, we obtain:

$$k = \frac{\frac{a}{4}\left(\frac{AS_2}{P_1} - \frac{P_1}{AS_2}\right) - e}{l_1^2} \quad \text{Equation } (a)$$

S_2 and a being constants, we may determine k by substituting the experimentally determined simultaneous values for P_1/A and l_1 in equation (a), substitute this value for k in formula 7, and thus obtain a continuous expression of P/A as a function of l. This is not basicially different from our usual procedure. In using Euler's equation, for example, we need a value for E. This value of E must be experimentally determined, and we may find this value from direct stress-strain measurements. Or, with the perfected method of testing pin-ended columns which we have described (3), (5), we very well might determine this value of E from only one test of a single pin-ended column, and use it to determine the buckling load of similar columns of varying lengths.

This latter procedure would result in establishing experimentally one constant for pin-ended columns loaded with zero eccentricity. In our case we have to establish experimentally the constant k for every series of tests, when each series has a different eccentricity.

I have stated that I hold any eccentric loading formula as being of only academic interest. But this is not true of the concentrically loaded pin-ended column. This, to my view, constitutes the essential criterion of value in the entire field of column behaviour (3), (4). I am at present inclined to the opinion that this is nearly as true for columns stressed beyond the proportional limit as it is for those stressed within the elastic limit.

If we give e the value of zero in formula 7 and in equation (a) we obtain:

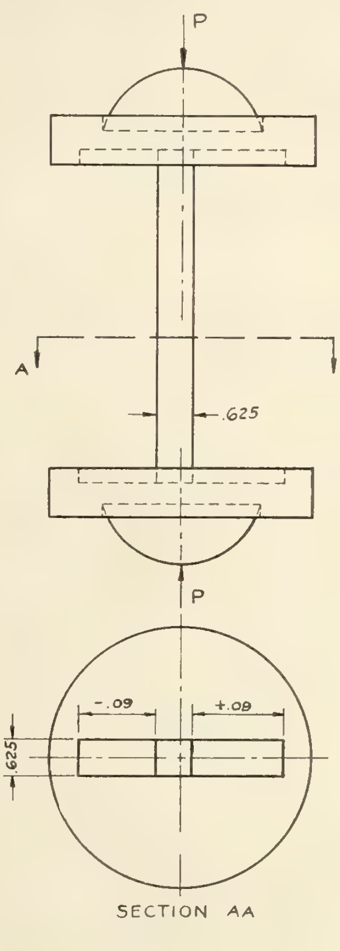

Fig. 2

$$P/A = \frac{2S_2}{a}\left\{\sqrt{\frac{a^2}{4} + (kl^2)^2} - kl^2\right\} \quad \text{Equation } (b)$$

$$\text{also, } k = \frac{\frac{a}{4}\left(\frac{AS_2}{P_1} - \frac{P_1}{AS_2}\right)}{l_1^2} \quad \text{Equation } (c)$$

If, in equation (*b*), we substitute equation (*c*) for k, we find, luckily for us, that the constant a cancels, and we obtain:

$$P/A = 2S_2\left[\sqrt{0.25 + \left\{\frac{1}{4l_1^2}\left(\frac{AS_2}{P_1} - \frac{P_1}{AS_2}\right)\right\}^2 l^4} - \frac{1}{4l_1^2}\left(\frac{AS_2}{P_1} - \frac{P_1}{AS_2}\right)l^2\right] \quad \text{Equation } (d)$$

The cancelling of the constant a does not mean that equation (*d*) becomes general. It remains restricted, since it is based on the analysis of a rectangular section. It remains so restricted even after we cancel the constant a. However, it is believed to be quite rigorously applicable to Z and to hat stringers in aero design, and to most sections encountered in civil engineering practice.

Equation (*d*) is further restricted to the short column range and to columns made of materials with substantially identical tension and compression stress-strain curves. In the long column range we have the formulae in reference ③ to guide us. The transition value, which distinguishes between the short and the long column range is the l/i which corresponds to the proportional limit stress. In terms of graphs this means that the Euler curve and the curve of formula 8, presently to be developed, should have one point in common, the proportional limit stress S_1. If we substitute S_1, the proportional limit stress, for $\frac{P_1}{A}$ in equation (d), we obtain the *Limit Strength Column Formula for Material of Variable Modulus:*

$$P/A = 2S_2\left[\sqrt{0.25 + \left\{\frac{1}{4l_1^2}\left(\frac{S_2}{S_1} - \frac{S_1}{S_2}\right)\right\}^2 l^4} - \frac{1}{4l_1^2}\left(\frac{S_2}{S_1} - \frac{S_1}{S_2}\right)l^2\right] \quad \text{Formula 8}$$

S_1 = proportional limit stress.
S_2 = upper yield stress.
l_1 = is obtained from the equation,

$$S_1 = \frac{\pi^2 E}{(l_1/i)^2}\text{; thus } l_1 = \pi i\sqrt{\frac{E}{S_1}}$$

E = initial modulus of elasticity.
i = minimum radius of gyration.

It is of interest to note that in the case of mild steel, in which S_1 and S_2 are substantially equal, formula 8 gives: $P/A = S_1 = S_2$. For a check on this result, see Fig. 12 in reference ⑤.

Test Equipment and Technique.

The test equipment used was that first described in reference ③, and further elaborated upon in reference ⑤. Reference ③ also contains one record (Fig. 19) of an eccentrically loaded steel column, similar to the aluminum column tests herein described. This record involved an error, which error was mentioned and was offered as a reason for a variation between the experimental results and those predicted by theory. Naturally this error was avoided in our present tests. This resulted in a much closer agreement between experimental and theoretical values. The column ends (see also reference ⑥) consisted of partial spheres mounted in a ring that guided the templet, and the templet in turn determined the location of the specimens. The specimens in this instance were 5/8 in. square 24 ST aluminum extrusions. The templet is shown in Fig. 2. It consists of a brass circular plate with an accurately centered slot exactly .625 in. wide. The plate is accompanied by spacers, or slugs, marked in order: .00 and 00, + .02 and − .02, + .09 and − .09, etc. The spacer marked + .09 is .090 in. longer, and the one marked − .09 is .090 in. shorter than those marked .00 in. With the spacers inserted in the slot and the specimen guided by both slot and spacers, this specimen is located with an eccentricity of .090 in. The design of the column-ends ③, ⑤ insures the fact that this eccentricity is maintained throughout the loading range.

The strain was measured with a Huggenberger strain gauge of 1/2 in. gauge length. The reading 16 on the strain gauge corresponded to the stress of 27,000 lb. per sq. in.

The ease with which accurate centering in the column-ends may be achieved is illustrated in Fig. 3, which represents a stress-strain curve obtained from a 3.10 in. long Z stringer of 24 ST aluminum. The stringer was provided with two electric gauges, one each on opposite bulbs. The centering in the machine took no more than one minute of time, because everything

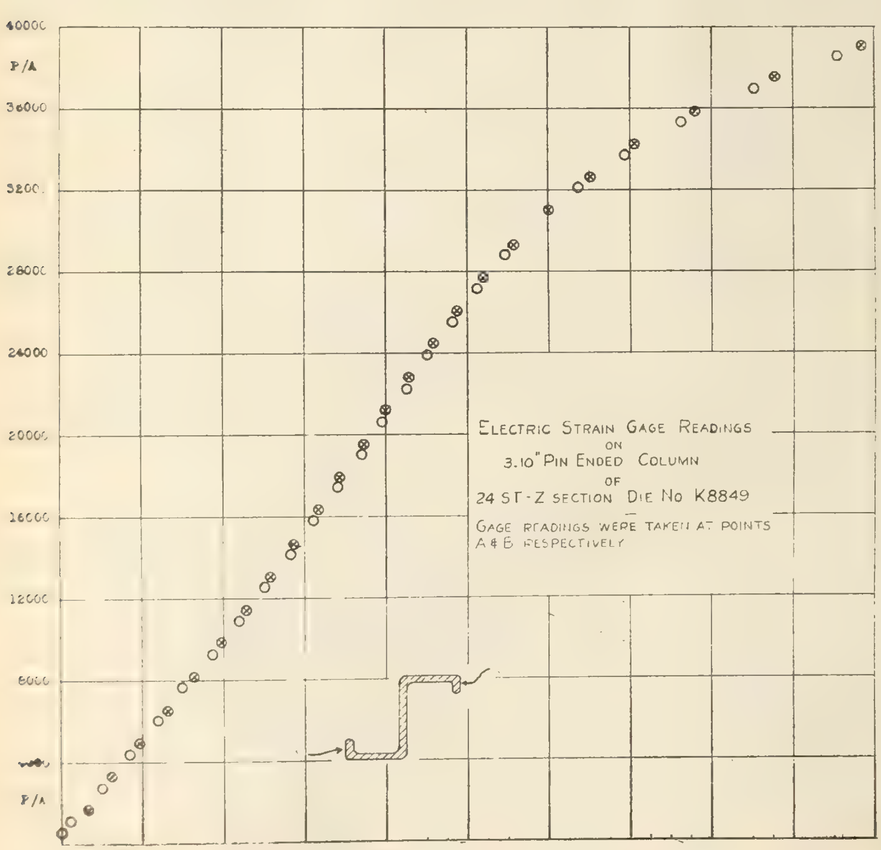

Fig. 3

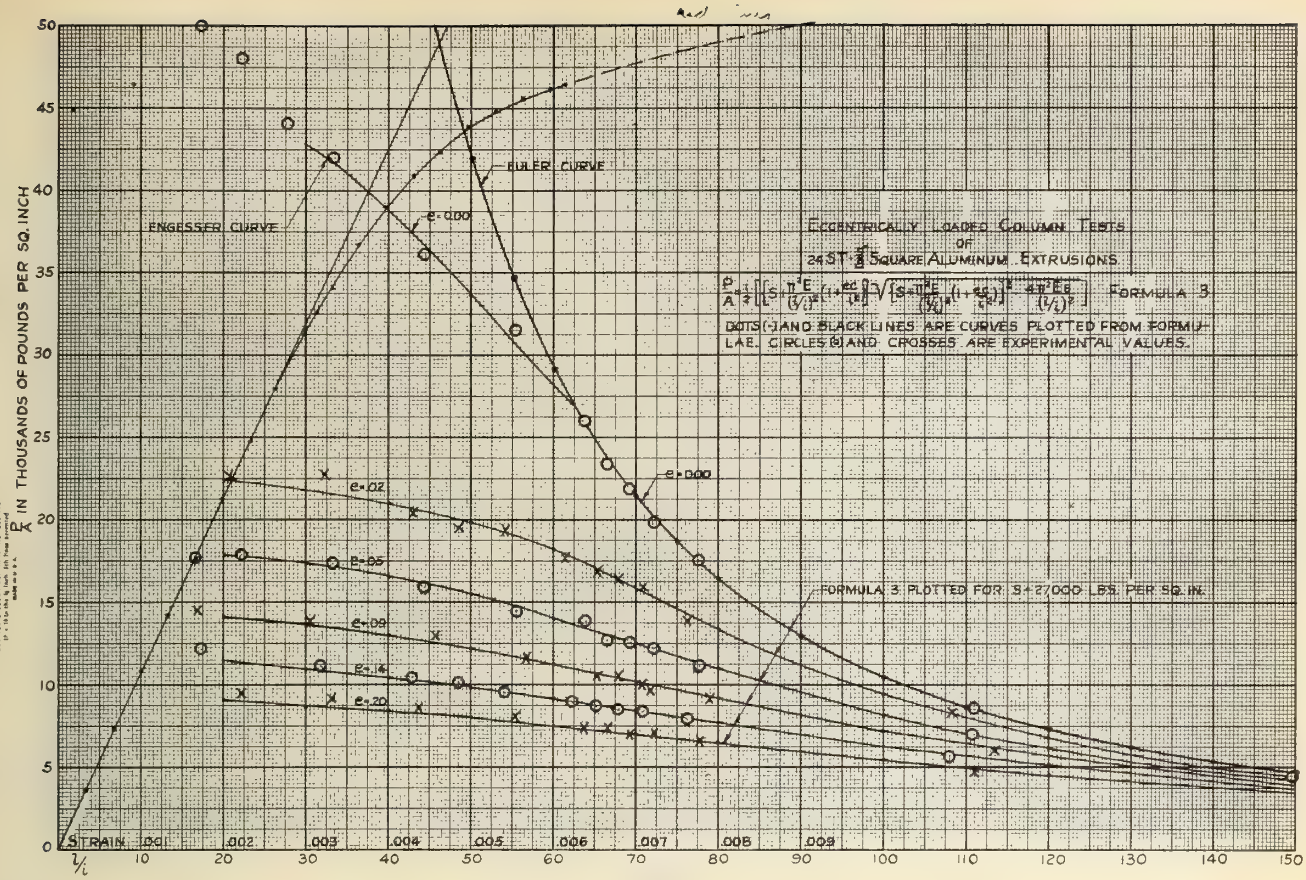

Fig. 4

fitted snugly. The coincidence of the two sets of readings suggests quite satisfactory concentricity relative to the major axis. This specimen constituted one test in a series of twenty. That concentricity relative to the minor axis also was obtained was evidenced by the fact that, of the twenty specimens tested, ten buckled in one direction and ten in the opposite direction.

Discussion of Test Results

We have now two sets of formulae—one set for the elastic functioning of columns, namely, the eccentric loading formula 2 and the wow formula 3 of reference ③ (for the wow formula, see Fig. 4), and a second set for the limit functioning of columns in the short column range, namely, formulae 7 and 8 of this paper.

For the elastic behavior of columns, I prefer formula 3 to formula 2, as it gives substantially the same values as formula 2. Being derived as one of two roots of a quadratic equation, the $\pm$ sign may be substituted for the $-$ sign, in which case the equation reduces to two values: $P/A = S_1$, and $P/A = \dfrac{\pi^2 E}{(l/i)^2}$. This was presented in reference ③ and confirmed by numerous tests, notably as shown in Fig. 12, reference ⑤.

Figure 4 presents, primarily, a test record of formula 3. The proportional limit stress of 27,000 lb. per sq. in. was substituted in the formula as were successive values of eccentricity, namely, .02 in., .05 in., .09 in., .14 in., and .20 in. The results were plotted and are represented by the solid black line graphs and dots. The experimental values fell as shown. It seems worthy of mention that all test records are here presented. The raw material was commercially obtained. Its history, however was not available. Whether all the stock came from the same source, whether or not it was stretcher straightened and, if so, how much, and whether or not it was all extruded through the same die was not ascertainable. The last named condition is unlikely, since the sizes varied more than $\pm$ .001 in. For specimens used in the tests, we selected bars varying less than $\pm$.001 in. in size, and specimens for one series of tests were all cut from one bar. Considering, therefore, the state of the raw material, it seems that Fig. 4 provides adequate proof of the validity of Formula 3 for stresses within the proportional limit.

Figure 4 also presents a stress-strain curve, an Euler curve, and an Engesser curve, the last two named being both theoretical and experimental. It appears that the stress-strain curve, between the limits

$$\left\{ \begin{array}{l} x = .00305 \\ y = 32{,}000 \end{array} \right\} \text{ and } \left\{ \begin{array}{l} x = .00475 \\ y = 42{,}800 \end{array} \right\},$$

can be very closely represented by the quadratic equation, $y = 18{,}400{,}000\,x - 10{,}000 - 1{,}535{,}000{,}000\,x^2$, in which y represents stress and x represents strain. The variable modulus is:

$$E' = \frac{dy}{dx} = 18{,}400{,}000 - 3{,}070{,}000{,}000\,x$$

$$P/A = \frac{\pi^2 E'}{(l/i)^2} = y, \text{ or } l/i = \pi\sqrt{\frac{E'}{y}} =$$

$$\pi\sqrt{\frac{18{,}400{,}000 - 3{,}070{,}000{,}000\,x}{y}} \qquad \text{Equation } (e)$$

The graph of this equation (e) representing the Engesser curve, is also shown in Fig. 4.

Figure 5 presents the graphs for formulae 7 and 8, as well as the graph for Euler's formula. The circles and crosses represent the experimental test results of the limit loads which the column test specimens supported. The specimens were the same as those used in the development of Fig. 4. The values plotted in Fig. 4 repre-

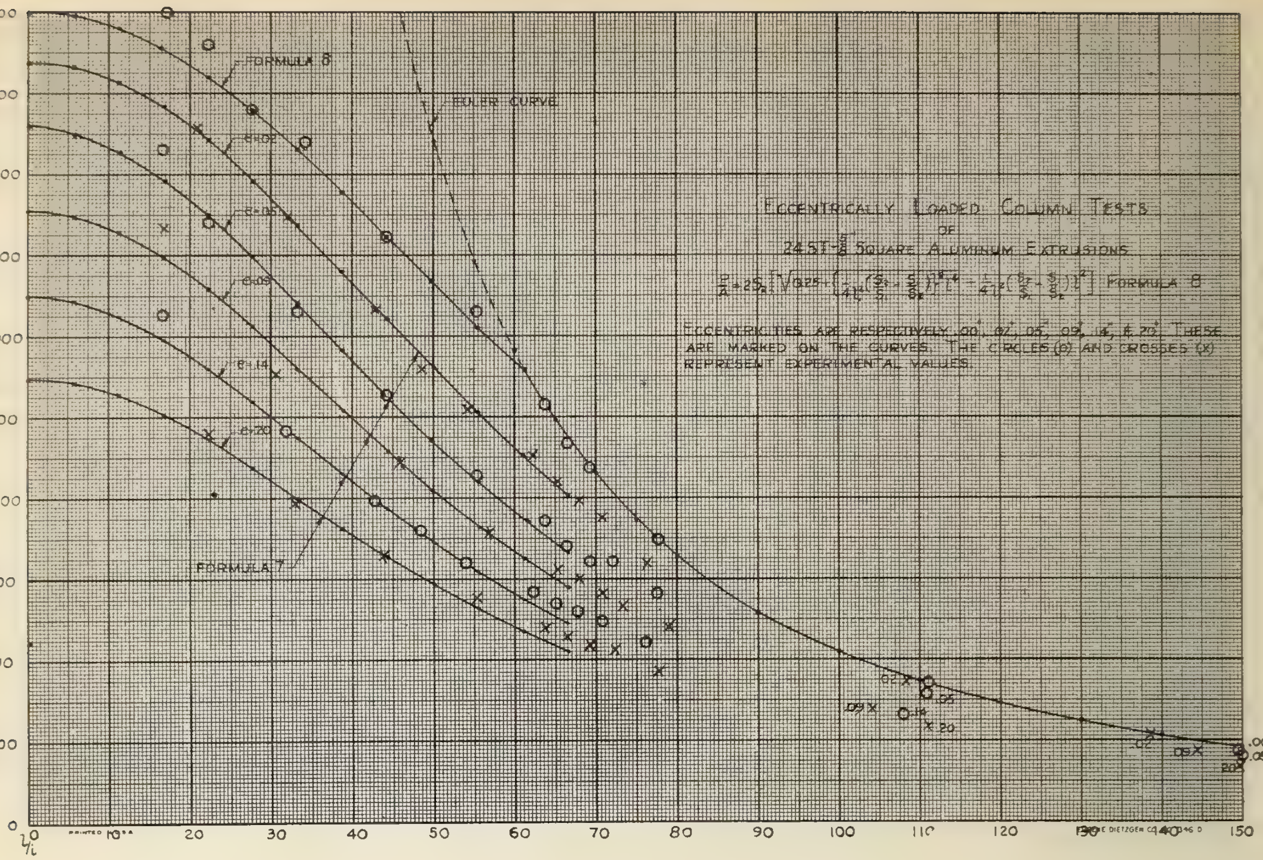

Fig. 5

sent intermediate load readings, and those in Fig. 5 represent ultimate or limit load readings. The experimental values for the case $e = 0$, are the same in Fig. 5 as those given in Fig. 4. However, the curve with which these experimental values are compared in Fig. 4 is the Engesser curve, and in Fig. 5 it is the newly developed formula 8.

The graphs of Fig. 5 were plotted for the value of $S_2 = 50{,}000$ and $S_1 = 27{,}000$. S_2 is the upper limit stress, as defined on page 772, column 2. As metals do not have an ultimate compression breaking strength, the selection of S_2 is somewhat arbitrary and involves the exercise of one's judgment. The constant k was determined by substituting the experimental values for l_1 corresponding to the values for l_1/i nearest to $l_1/i = 43$, in equation (a).

Figure 6 presents a stress-strain curve and limit load pin-ended column curves of 75 ST extrusion and die No. K8849, and tested as described in reference ⑤. The Engesser curve was not obtained in the same way as the one shown in Fig. 4. Instead, it was derived by measuring the tangent to the stress-strain curve at various points, substituting this for the value of E' in the equation, $P/A = \dfrac{\pi^2 E'}{(l/i)^2}$, and solving for l/i. The graph for formula 8, as applied to the 75 ST aluminum alloy, Fig. 6, was obtained by substituting 80,000 lb. per sq. in. for S_2, 52,000 lb. per sq. in. for S_1 and since $l_1/i = 45$ and $i = 0.1856$, $l_1 = 8.35''$ was substituted for l_1.

Both formulae 7 and 8, and the Engesser formula also, I believe, are limited in range. A column of zero length is hardly conceivable. Any values which our formulae give for such zero lengths, are thus fictitious. When the length of our columns approaches zero, our formulae values approach the fictitious. The shorter the column the greater becomes the distortion of the cross-section of the column which results from the expanding of the cross-section on the compression side and the contracting on the tension side. We have ignored this change of cross-section as we commonly ignore it when we say $S = P/A$. In the intermediate column length range, I believe, it may well be ignored. In the very short column length range, the effect of this factor assumes considerable importance. I would say, therefore, the range of applicability for formulae 7 and 8, in case of 24 ST aluminum extrusion, is $18 < l/i < 65$. For R 303 T and 75 ST aluminum extrusion, the range is $18 < l/i < 45$.

For the five columns of lengths less than $l/i = 20$, which were tested (see Fig. 5) the value for P/A is consistently higher than the values given by the formula.

Conclusion

We have checked two column formulae applicable only within the elastic limit, namely, formula 3, and the special case of formula 3, or Euler's formula, to which formula 3 reduces when the eccentricity e is zero. Further, we have developed and checked by experimental test results, two more formulae, 7 and 8, which give the limit or capacity column loads. The significance of this work depends largely on one's point of view. For the designing engineer, formulae 3 and 7 hold no interest. They have no more relation to any practical problem, that I can conceive, than has the much vaunted secant formula ④. To be of use to the designer, he should know at the outset what value to substitute for e. As to this sacred thing called "engineering judgment" being one's guide, I can only say that after thirty-five years of devotion to the subject of strength, and a good share of that time this devotion was especially directed to columns, my judgment fails me completely, nor have I ever seen anyone to whose judgment in this matter I would attach any value.

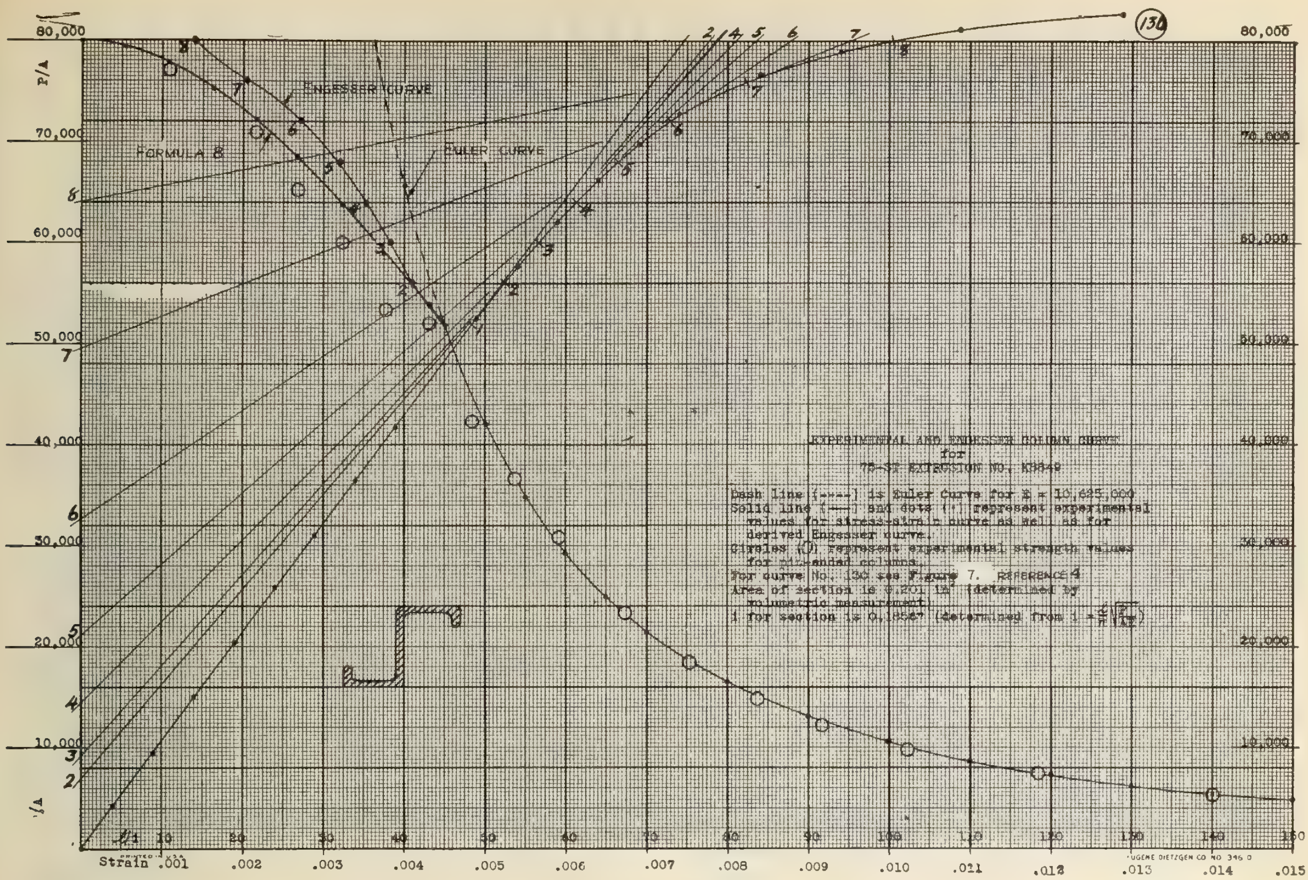

Fig. 6

To me, nevertheless, as an engineering philosopher, both formulae 3 and 7 hold great interest—formula 3, because, in the limiting case when $e = 0$, it reduces to Euler's formula; and formula 7, because, in the limiting case when $e = 0$ it reduces to formula 8. So formula 3 and formula 7 serve the purpose of supporting Euler's formula and formula 8, respectively. Euler's formula, at this time, is hardly in need of support. Formula 8, on the other hand, being new, looks for support wherever it can be found.

I have called formula 7 academic. By checking it experimentally for five different eccentricities and finding it as reliable as any column tests ever made for confirmation of any column theory, it lends weight to our faith that the formula is equally reliable when $e = 0$ is substituted in it and thus reduces to formula 8.

We thus have, at present, three primary theories offering to guide us in strength analyses of pin-ended columns, made of variable modulus material:

1. Formula 8;
2. Engesser formula, $P/A = \dfrac{\pi^2 E'}{(l/i)^2}$; and
3. The Double Modulus Theory.

See a paper by W. R. Osgood⑦. Mr. Osgood, in a more recent publication ⑧ makes one very significant remark, on page 1566. He says: "It would be possible to design by means of the double-modulus theory, given the compressive stress-strain curve of the material; but the best testing technique results in wider discrepancies between theoretical and experimental values in the plastic range than in the elastic range."

Regarding this statement by Osgood, I would like to offer a two-fold discussion. First: When he speaks of the best column testing technique, he probably has in mind the column testing technique practised by the National Bureau of Standards of Washington, D.C. The results of column tests published by this Bureau show a scatter of experimental points, even in the elastic range, of some 10 per cent. This may be the best testing technique Mr. Osgood knows of. He may be right, but I doubt it. Second: I regard the double modulus column theory as a pointed illustration of what a wrong sense of value, the wrong assumptions, coupled with some mathematical juggling, lead to. I hold that in the theory of strength we have three basic formulae which, in the order of their importance, are:

1. $F = ma$, or Newton's law of motion;
2. $P = \dfrac{\pi^2 EI,}{l^2}$ or Euler's formula; and last and least
3. $S = Ee$, or Hooke's law.

I attempt to be a philosopher, but even a philosopher needs some assumptions, some articles of faith. One of my articles of faith is to the effect that the laws of nature are simple. They are complex only so long as our understanding is incomplete.

The Engesser formula is the very antithesis of the double modulus theory. It represents the essence of simplicity. The second most important strength formula listed (Euler's formula) gives strength as a function of modulus, not of stress. What then is more natural and more sound than to substitute a variable E^1 for the constant E in Euler's equation? This is all right for anyone with the correct sense of value, and when we say that, we usually mean our own. I think most of my practising engineering friends will probably agree. Not, however, many of my professional colleagues. They seem to be so saturated with the fetish of making stress an exclusive agency for determining strength, that they regard stress analysis as synonomous with strength

(Continued on page 783)

FIELD DECAY CHARACTERISTICS OF LARGE HYDRO-ELECTRIC GENERATORS*

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Paper presented before the Montreal Branch of The Engineering Institute of Canada and the Montreal Section of the American Institute of Electrical Engineers on October 26th, 1944.

Introduction

To operators of large hydro-electric generators one constant concern is the damage which may result when a coil failure or fault of any kind develops in the winding of a generator. The photograph in Fig. 7 illustrates the damage to the stator iron which may be found after a coil failure. It is obvious that to completely repair such damage will involve the restacking of one section of the stator iron. This necessitates a machine outage of considerable duration. The cost of this outage must not only include the actual labour and material used but must include the loss of revenue that results from the idle generator, and may have to include as well the cost of buying power during peak load periods. At the very least the loss of one large unit in most hydro-electric stations will cause inefficient operation of the remaining units and this inefficient operation must be charged to the outage. Hence it will be apparent that, if the damage can be reduced to such a point that the iron burning is of little consequence, a considerable saving will be achieved and generator availability will be increased. On large hydro-electric systems such as are found in Canada and United States, having a capacity of 1,000,000 kva. or greater in twenty-five or fewer generators, this is an important consideration.

In an attempt to limit the damage resulting from winding faults in large hydro-electric generators, considerable time and money have been spent in applying high speed relays to detect the fault, and high speed circuit breakers to remove the sources of fault current as rapidly as possible. Modern generator relays will operate in one cycle with a fault current of perhaps one per cent of full load current. Modern oil circuit breakers will interrupt fault currents in from three to eight cycles, and air circuit breakers will interrupt the field current from the exciter in about five cycles. However, as far as the author is aware, the problem has not been studied in too great detail beyond this point and it is here that considerable improvement may be made at, if not the least cost, a very moderate expenditure.

After all sources of supply of current to a generator, including the field circuit breaker, have been opened, the generator continues to supply current to a winding fault because the field current is still decaying in the circuit formed by the generator field and its discharge resistance. This discharge resistance is connected across the field as the field circuit breaker is opened.

It should also be noted that if there is no low tension circuit breaker between the generator and the transformer bank, then the generator and transformer bank and associated low tension equipment must be considered as a unit in the matter of protection. Thus a fault on the transformer bank or other low tension equipment will not be completely removed until the generator field current has decayed almost to zero.

The open-circuit transient time constants of several large hydro-electric generators are listed in Table I, along with the time constants when modified by the value of field discharge resistance specified by the manufacturer. Also the time constants are shown when modified by the effect of a single line-to-ground fault on the machine terminals, and by the effect of a three-phase fault on the machine terminals①. It may be seen that in the case of a ground fault, from 35 to 70 cycles may be required for the current to decrease to 37 per cent of its initial value. There is a great difference between this period of time and the circuit breaker and relay times mentioned previously.

TABLE I—GENERATOR TIME CONSTANTS

Generator	Rated Kva	Tdo'*	Tdo'‡	L-G Fault Td'	3-Phase Fault Td'
A	50,000	7.70	1.39	0.93	0.57
B	65,000	10.50	1.89	1.16	0.73
C	75,000	9.80	1.77	1.06	0.63
D	75,000	5.90	1.10	0.58	0.38

*All time constants are given in seconds. T_{do}' as given by the manufacturer.

‡T_{do}' based on the field discharge resistance specified by the manufacturer.

These time constants cannot be made smaller, because to do this requires a larger discharge resistance which in turn imposes a higher voltage initially on the field and its associated equipment.

Presumably the designer has selected a value of discharge resistance which, with the greatest field current, produces an initial field voltage such that only a safe margin is maintained for the field insulation.

The object of this paper is to draw attention to this problem of the time required for generator field current decay and to outline one method** which will afford at least a partial solution.

Detailed Considerations

Figure 1 shows a generator field circuit breaker, discharge resistance R_1, a contactor and second block of discharge resistance R_2. Neglecting for the moment the contactor and second block of resistance, when the air breaker opens, the field current decays from its initial value I_{1o} as shown by curve "A" in Fig. 2 and Fig. 3. Figure 3 shows the ordinary exponential current decay line of Fig. 2 when plotted on semi-log coordinates. A straight line characteristic is obtained, from which the time constant of the L-R circuit is easily determined, as the time at which the current decreases to $1/\epsilon$ or 0.368 of its initial value, I_{1o}. The initial voltage imposed on the field and its associated equipment is $I_{1o}.R_1$ and obviously this voltage also decays exponentially.

To increase the rate of decay of the current after it tends to level off, a second block of resistance, R_2 can be inserted in the field circuit by a contactor after an elapse of from 10 to 40 cycles depending on the circuit constants. This increase in resistance causes the current to decrease as shown by the curve "B" in Figs. 2 and 3.

*This paper has been awarded the Phelps Johnson prize of the Institute for the year 1945.

**Mr. E. G. Ratz, Division Engineer, Meters & Relays, Canadian Westinghouse Co. Ltd., Hamilton, originally suggested that the method described might be used to effect an improvement in the rate of decay of field current.

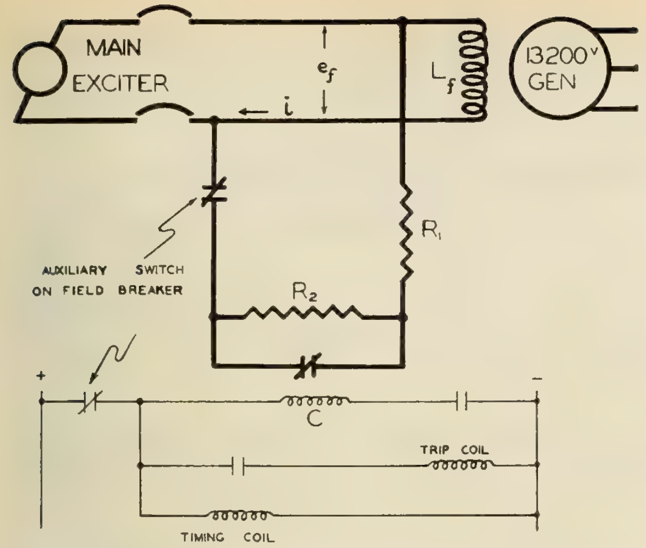


Fig. 1—Generator Field Circuit. Showing discharge resistances R_1 and R_2 and contactor C with its control circuit.

Obviously the value of R_2 and the time at which it is inserted must be such that the field voltage does not materially exceed the initial value $I_{1o}.R_1$.

The contactor coil C, Fig. 1, is normally de-energized and voltage is applied to its operating coil, after a definite time delay, by a timing relay which is in turn started by an auxiliary switch on the field breaker, which is closed when the breaker is open. This control circuit is shown in Fig. 1.

When considering the subject of adding resistance in a generator field circuit, as the field current decreases, so that the rate of decrease of field current will be maintained, it is interesting to see how any particular finite values of resistance chosen will compare with the ideal theoretical limit. This theoretical limit may be obtained by assuming that the voltage across the field is held constant, even though the current is continuously decreasing, by continuously increasing the discharge resistance.

This may be illustrated as follows:

The circuit under consideration is shown in Fig. 1. L_f is the inductance and is constant, i is the decreasing field current, R_1 is the total circuit resistance and e_f is the voltage across the resistance. If the circuit constants do not change, the decay of field current will be curve "A" previously mentioned, and will have the familiar equation:

$$i = I_{1o}\epsilon^{-\frac{R_1}{L_f}t}$$

where I_{1o} is the initial value.

However let it be assumed that due to an increasing resistance e_f remains constant at E_{Fo}.

The loop voltage equation for Fig. 1 is:

$$L_f.\frac{di}{dt} + i.r = 0$$

$$\text{But } i.r = e_f = E_{Fo}$$

$$\text{Therefore } L_f.\frac{di}{dt} + E_{Fo} = 0$$

The solution of this equation is:

$$i = I_{1o} - (E_{Fo}/L_f).t$$

which is the equation of the straight line shown by curve "C", Fig. 2. On semi-log co-ordinates this straight line becomes curve "C", Fig. 3.

While practically the curve "C" cannot be used, the area under it is the least possible and it is interesting and useful to compare any finite values of resistance selected to this theoretical limit. It is fairly obvious that any particular value of a second block of resistance which gives a decay curve such as "B", and conforms to the condition:

$$I_{2o}\ (R_1 + R_2) = I_{1o} \cdot R_1$$

will be parallel to the tangent to the curve "C" at the point where the curve "C" has the value I_{2o}. Also it may be seen that if the tangent curve itself was selected as the second part of the decay curve, the voltage condition would not be fulfilled as at T_2 the current is considerably greater than I_{2o}. These facts provide a method of obtaining the value of the second block of resistance and the time at which it must be inserted. For a given machine, curves "A" and "C" may be calculated and plotted. Three or four trials with a pair of set-squares, starting from lines tangent to curve "C" and moving parallel to the tangent to intersect curve "A" at the value of current corresponding to the tangent point, will enable curve "B" to be determined so that a minimum area will lie under curves "A" and "B".

While the value of the second block of resistance may be determined very well by the graphical method described, an analytical expression for the switching time T_1 is developed in Appendix 1 and is:

$$T_1 = (L_f R_1)\ log_e\ [(R_1 + R_2)/R_1]$$

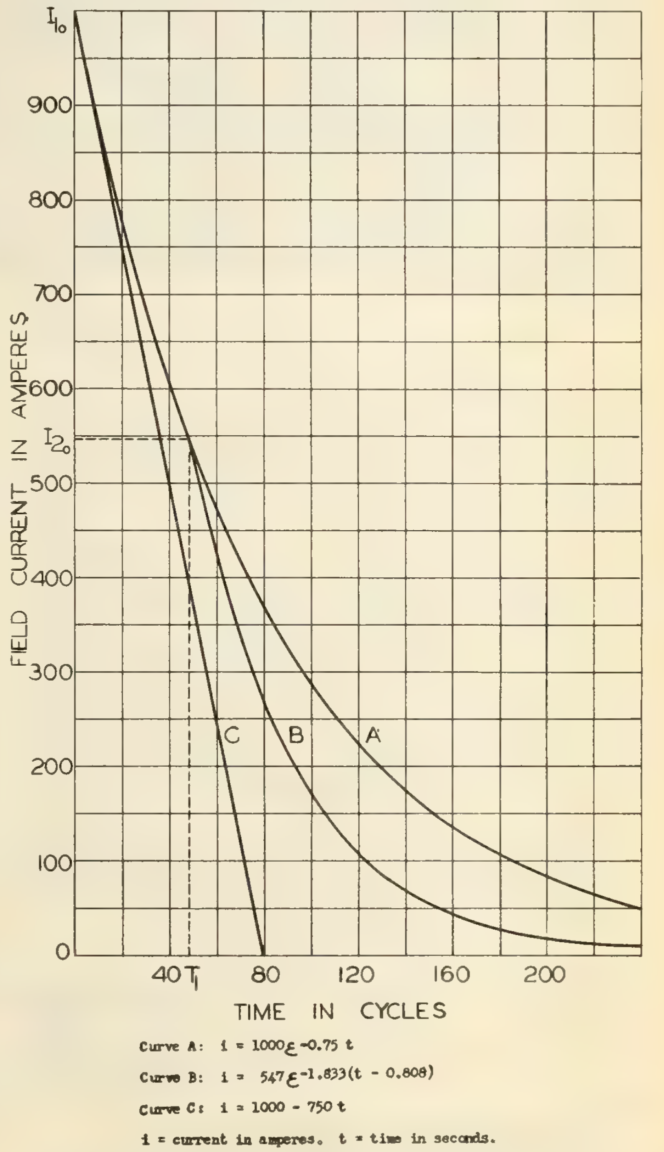


Fig. 2—Field Current Delay Curves. Equations of Curves A, B, and C are given with Fig. 3.

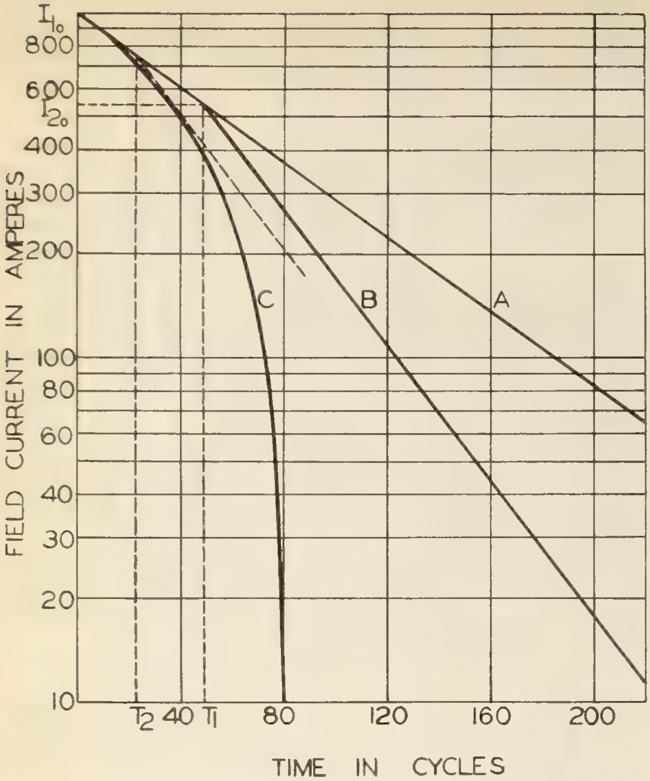
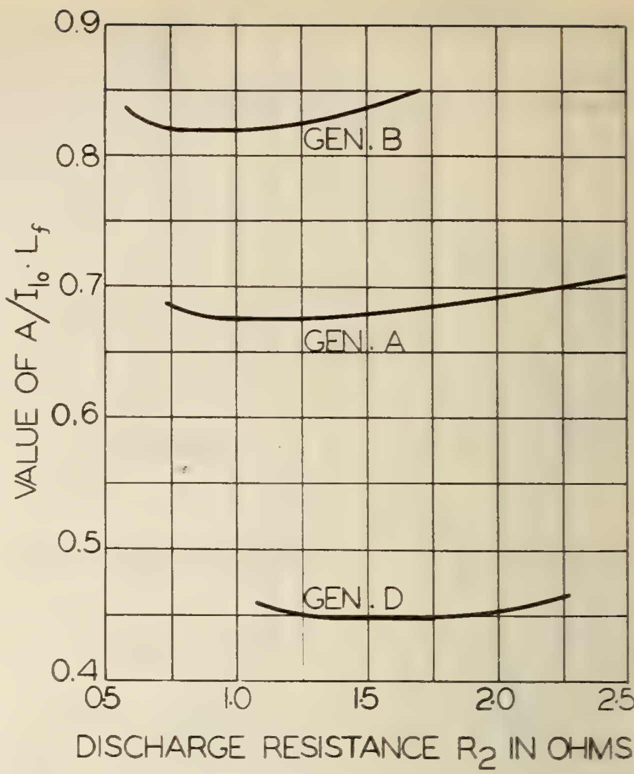


Fig. 3—Field Current Decay Curves.

Curve A: $i = 1000\ \epsilon^{-0.75t}$
Curve B: $i = 547\ \epsilon^{-1.833\ (t-0.808)}$
Curve C: $i = 1000 - 750t$
i—current in amperes. **t—time in seconds.**



A is area under curves A and B of Figures 2 and 3.
I_{1o} is initial value of field current.
L_f is field inductance.
R_2 is second block of field discharge resistance.

Fig. 4

An expression for the area under the curves is developed in Appendix 2 and is:

$$A = I_{1o} \cdot L_f \left[1/R_1 + R_1/(R_1 + R_2)^2 - (1/R_1)\epsilon^{-\frac{R_1}{L_f} T_1} \right]$$

For the generators A, B and D, the value of $A/I_{1o}.\ L_f$ as a function of R_2 is plotted in Fig. 4 and it may be seen that this changes very slowly in the region of its minimum value. Hence, as stated previously, the graphical method is to be preferred for selecting the switching time and resistance value.

There is another aspect of this problem which must be considered. This is the value of the field current to be used at zero time and the effective inductance to be used in determining the time constants.

This, in turn, will depend largely on whether minimum decay is to be selected for a single line-to-ground fault, a line-to-line fault, or a three-phase fault.

The maximum initial field current, after the occurrence of a terminal fault is given by ③:

$$I_{1o} = I_f\ (x_d/x_d')$$

where I_f is the maximum field current which will be supplied to the machine under any operating conditions.

The open-circuit transient time constant, T_{do}' must be modified as follows for fault conditions ①:

$T_d' = T_{do}'\ (x_d'/x_d)$ for a three-phase fault

$T_d' = T_{do}'\ (x_d' + x_2)/(x_d + x_2)$ for a phase-to-phase fault

$T_d' = T_{do}'\ (x_d' + x_2 + x_o)/(x_d + x_2 + x_o)$ for a single line-to-ground fault

where:

x_d is the generator direct axis reactance
x_d' is the generator transient reactance
x_2 is the generator negative sequence reactance
x_o is the generator zero sequence reactance

If the method of grounding the neutral point of the generator is such that the machine may be considered to be "solidly grounded" then it will be seen that the ground fault current will have the least effect on the time constant and the field decay curve based on this time constant must be used in determining the switching time and the value of the second block of discharge resistance. This is necessary to keep the field voltage to the proper value. If however, the machine is grounded through some external resistance-reactance combination which limits the ground fault current to a very small value, a phase-to-phase fault or a three-phase fault will be the determining condition.

It might be mentioned that opening the field at the same time that full load is dropped will not produce a field voltage in excess of that produced under fault conditions. This is because, though the field current has decreased by a smaller percentage at the time a second block of resistance is inserted, the initial field current is not multiplied by the factor x_d/x_d'.

Test Data

Tests were conducted on Generators A and B of Table I during the first investigations of the rate of decay of field current while most of the analysis was done later. Figure 5 shows two oscillograms obtained during the test work on Generator A. The data from these oscillograms and from several others are plotted in Fig. 6.

From Figs. 5 and 6 the effect of the second block of resistance may be clearly seen. The oscillograms show the field voltage and it may be noted that for the value of R_2 used, a shorter switching time should have been selected to increase the field voltage at time T_1 to its initial value at zero time, and to provide an increased rate of current decay sooner.

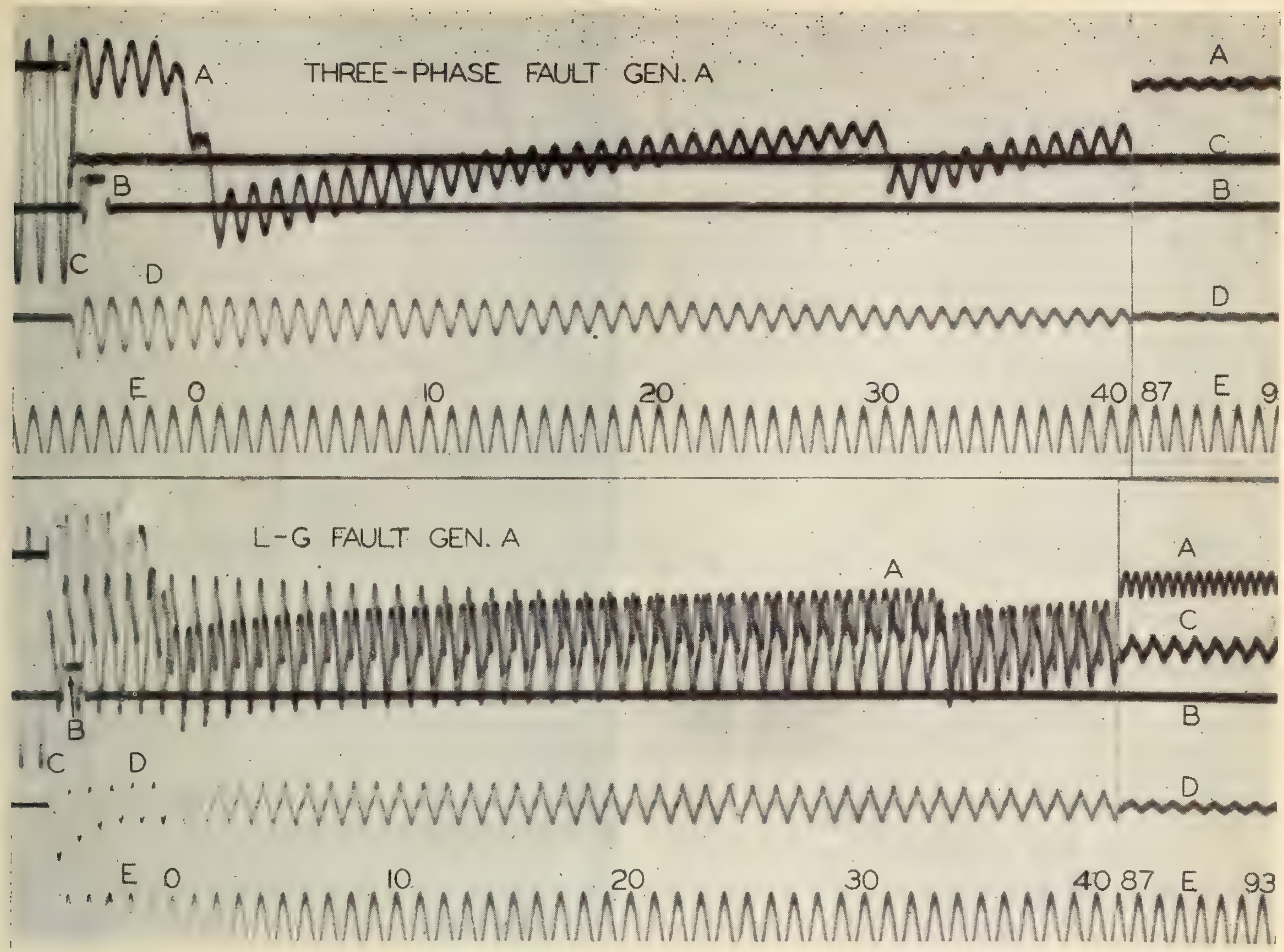


Fig. 5—Oscillograms of Generator Faults.

A—Generator field voltage
B—D.C. voltage on trip relay
C—Generator armature voltage
D—Generator armature current
E—60 cycle timing wave

Figure 6 shows very clearly the decrease in decay time which can be effected by the second block of resistance. The test conditions and results are summarized in Table II.

It should be mentioned that the relay and control circuit for inserting the second block of resistance functioned excellently during all test work. The relatively simple and inexpensive equipment is definitely an advantage of this scheme.

Throughout this work only the transient component of armature current has been considered. It is believed that this results in some simplification and that the effect of the subtransient and direct current components on the first few cycles of armature current, and on the initial value of field current and hence on the field voltage, can be allowed for by the use of a multiplying factor if an exact solution is not desired.

Conclusions

(1) The period of time required for the field current of a large hydro-electric generator to decay to some low value is of such length, compared to the relay and circuit breaker time, that some means should be devised for reducing this time.

(2) One method of reducing the current decay time is to increase the field discharge resistance at some period of time after the field breaker is opened, by means of a contactor, a timing relay, and a block of resistance.

(3) A preliminary analysis presented here should permit the selection of the approximate resistance value and switching time to provide good over-all performance for any given generator.

(4) The author, while not trying to enter the field of generator design, believes as a result of the test work that it may be possible to secure better co-ordination between the value of field discharge resistance selected for a generator and the insulation level of the generator field and its associated equipment. The result should be a decrease in the time constant of the field circuit.

The author wishes to acknowledge the assistance of F. H. Duffy, Aluminum Company of Canada Limited.

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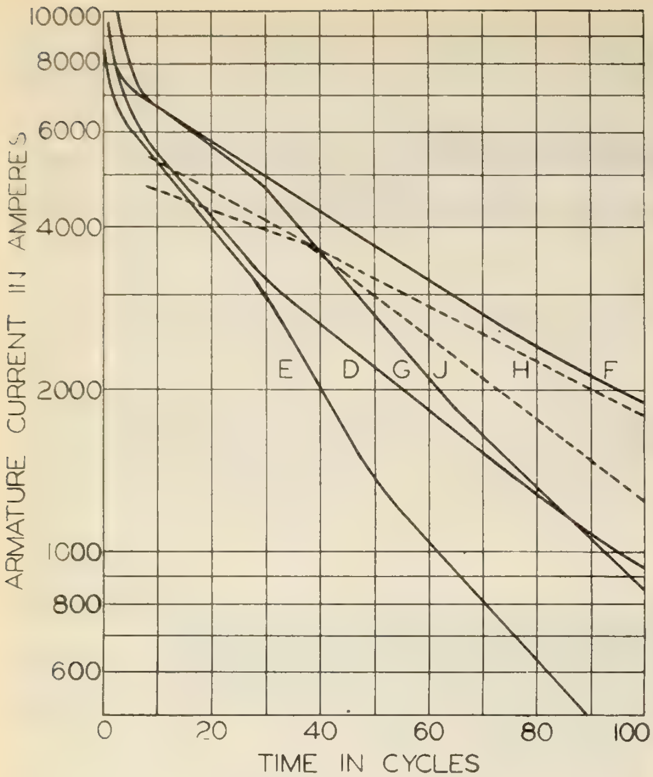
② Relay Systems, I. T. Monseth and P. H. Robinson, McGraw-Hill, 1935, chapter VI.



D - Three-Phase Fault Gen. B R_1 = 0.75 ohms
E - Three-Phase Fault Gen. B R_1 = 0.750 ohms
R_2 = 1.20 ohms
F - L-G Fault Gen. B R_1 = 0.75 ohms
G - L-G Fault Gen. B R_1 = 0.750 ohms
R_2 = 1.20 ohms
H - L-G Fault Gen. A R_1 = 0.89 ohms
J - L-G Fault Gen. A R_1 = 0.89 ohms
R_2 = 0.85 ohms

Fig. 6

Fig. 7

APPENDIX 1

Referring to Figure 2:

The equation of curve "A" is:

$$i_1 = I_{1_0}\,\mathcal{E}^{-\frac{R_1}{L_f}t}$$

at $$T_1, i_1 = I_{1_0}\,\mathcal{E}^{-\frac{R_1}{L_f}T_1}$$

$$= I_{2_0}$$

Also at T_1 $\quad I_{2_0}(R_1 + R_2) = E_{F_0}$

$$= I_{1_0} \cdot R_1$$

Therefore $$I_{1_0}\,\mathcal{E}^{-\frac{R_1}{L_f}T_1} \cdot (R_1 + R_2) = I_{1_0} \cdot R_1$$

or $$\mathcal{E}^{-\frac{R_1}{L_f}T_1} \cdot (R_1 + R_2)/R_1 = 1$$

Taking logs of both sides and rearranging:

$$T_1 = (L_f/R_1)\log_e\left[(R_1 + R_2)/R_1\right]$$

APPENDIX 2

Referring to Figure 2:

The equation of curve "A" is:

$$i_1 = I_{1_0}\,\mathcal{E}^{-\frac{R_1}{L_f}t}$$

The equation of curve "B" is:

$$i_2 = I_{2_0}\,\mathcal{E}^{-\frac{(R_1+R_2)}{L_f}(t - T_1)}$$

The area under these curves is:

$$A = \int_0^{T_1} i_1 \cdot dt + \int_{T_1}^{\infty} i_2 \cdot dt$$

$$= I_{1_0}\int_0^{T_1}\mathcal{E}^{-\frac{R_1}{L_f}t} \cdot dt + I_{2_0}\int_{T_1}^{\infty}\mathcal{E}^{-\frac{(R_1+R_2)}{L_f}t} \cdot \mathcal{E}^{\frac{(R_1+R_2)}{L_f}T_1} \cdot dt$$

$$= I_{1_0}\left[-\frac{L_f}{R_1}\mathcal{E}^{-\frac{R_1}{L_f}t}\right]_0^{T_1} + I_{2_0}\left[-\frac{L_f}{(R_1+R_2)}\mathcal{E}^{-\frac{(R_1+R_2)}{L_f}t} \cdot \mathcal{E}^{\frac{(R_1+R_2)}{L_f}T_1}\right]_{T_1}^{\infty}$$

$$= I_{1_0}\left[-\frac{L_f}{R_1}\mathcal{E}^{-\frac{R_1}{L_f}T_1} + \frac{L_f}{R_1}\right] + I_{2_0}\left[\frac{L_f}{(R_1+R_2)}\right]$$

But $I_{2_0} = I_{1_0} \cdot R_1/(R_1 + R_2)$

Therefore $A/I_{1_0} \cdot L_f = 1/R_1 + R_1/(R_1+R_2)^2 - (1/R_1)\mathcal{E}^{-\frac{R_1}{L_f}T_1}$

TABLE II—TEST RESULTS

Generator	Initial Conditions		Type of Fault	Discharge Resistance			Armature Amperes at 10 ∽	Armature Amperes at 90 ∽
	Armature Kv	Field volts		R_1 Ohms	R_2 Ohms	Time Cycles		
A	13.2	70.3	3-ϕ	0.89	—	—	5300	2000
A	13.2	70.3	3-ϕ	0.89	0.85	34	4450	1550
A	13.2	70.3	L-G	0.89	—	—	4650	1450
A	13.2	70.3	L-G	0.89	0.85	34	4500	800
B	14.7	70.0	3-ϕ	0.75	—	—	5500	1080
B	14.7	70.0	3-ϕ	0.75	1.20	30	5300	550
B	14.7	70.0	L-G	0.75	—	—	6600	2100
B	14.7	70.0	L-G	0.75	1.20	30	6600	1050

COLUMN FORMULA FOR MATERIALS OF VARIABLE MODULUS

(*Continued from page 777*)

analysis. Some seem to go even further, and regard "mathematical" as synonomous with "theoretical". A theory, then, which is so simple that one cannot express it mathematically, and which does not involve stress, runs off like water off a duck's back.

In support of formula 8, we have the fact that in Fig. 5 the curve for formula 8 is substantially identical with the Engesser curve in Fig. 4. In Fig. 6, although not identical, it is very similar to it. It may now be argued that, if formula 8 is no better than the Engesser equation, then I have not shown anything of any value. This again depends on one's sense of value. Formula 8 may be plotted more easily than the Engesser formula, and does not require a refined determination of the compression stress-strain curve beyond the elastic limit. This is not a very valid argument, and I, for one, shall never plot another graph of formula 8. If I should want it for design purposes, I shall either draw a straight line graph, or write it in the form of a compromise first degree equation.

What I personally regard as a point worthy of note is that formula 8 was developed without reference either to Hooke's law or to stress analysis. S_1 in the formula is called proportional limit stress, but in reality, philosophically, it is not stress. Remember that S_1 was derived from $\frac{P}{A} = \frac{\pi^2 E}{(l_1/i)^2} = S_1$. It is therefore the Euler formula which is represented by S_1.

It seems to me that the stress analysts have had their day in court. They have cluttered up our unfortunate theory of strength with a lot of alleged theory, some of it indigestible rubbish. It seems to me about time that the pendulum should begin to swing back. I believe it is slowly swinging back. I offer his paper as an example of how a sound strength analysis may be written without reference to Hooke's Law or to elastic stability.

Acknowledgment is expressed to Mr. J. B. Macphail of Montreal for helpful suggestions and criticisms as well as to the Horace H. Rackham School of Graduate Studies of the University of Michigan for aid received.

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AIRCRAFT PERFORMANCE TESTING AND REDUCTION BY THE "iw" METHOD

(*Continued from page 771*)

Although brief mathematical methods of performance estimation are available, the graphical method employing power required and power available curves is widely used. In many cases the users of this method plot a large number of separate curves showing power required and available at different combinations of gross weight and altitude. Much labour can be saved by using one sheet showing a P_{iw}, V_{iw} curve (P_{iw}=power required) and P_{iw_a}, V_{iw} curves (P_{iw_a}= power available) at different altitudes, and another sheet showing C_{iw} as a function of P_{iw} at various values of V_{iw}.

From Month to Month

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

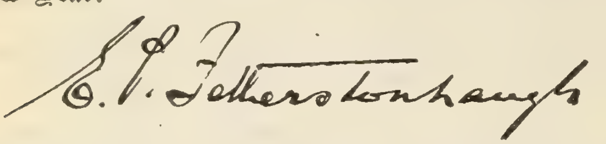
A Christmas Message

Not for six long years has it been possible for a president of the Institute to send the good old message, "A Merry Christmas and a Happy New Year," without a pang of regret that for many of our members it would be a Christmas far from home and spent in surroundings of the grimmest character.

Now that the "cease fire" has sounded and we are welcoming home those who, with courage, skill and ingenuity, have faced the enemy and beaten him at his own game, we may to some extent relax and enjoy the festive season as it should be enjoyed.

That there are serious problems still ahead of us we need not deny. But with confidence we can look to engineers to perform their part in their solution with the same loyalty, skill and devotion that have characterized their activities in the great conflict that has passed.

And so to each member of The Engineering Institute of Canada my message goes forth without reservations—May you enjoy a Merry Christmas and a Happy New Year!



THE SIXTIETH 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 1946 will be convened at Headquarters at eight o'clock p.m. on Thursday, January 31st, 1946, 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 Mount Royal Hotel, Montreal, at ten o'clock a.m. on Thursday, February 7th, 1946.

POLYTECHNIQUE MAINTAINS ITS LEAD

A total of 64 applications from the Ecole Polytechnique de Montréal for Student membership in the Institute were accepted at the Council meeting held in Regina, Sask., last month. This brings to 68.3 the percentage of students in attendance at the Ecole who belong to the Institute. In the three senior classes, less than three per cent are not members.

The Institute has always received active support from Polytechnique and its graduates, many of them having served as presidents or senior officers. In recent years the students have shown a practical interest by joining in large numbers, but this year's figures constitute a record. Although the Ecole is far from being among the larger engineering schools in Canada, it has a higher percentage of Student members in the Institute than any other.

Well done, Polytechnique!

ANNUAL MEETING IN MONTREAL

Plans have been completed to hold the next Annual General and Professional Meeting of the Institute at Montreal on February 7th and 8th, 1946. This will be the Sixtieth Annual Meeting, although the Diamond Jubilee of the Institute falls in 1947.

Recent pronouncements in the press forecast an improvement in transportation facilities, since the troops scheduled to return to Canada in the near future are to be repatriated before the middle of January.

A careful survey indicates that, in spite of congested conditions, it will be possible to accommodate the number of out-of-town members who usually attend such meetings in Montreal. The hotels have guaranteed a number of rooms and, although it may not be possible to house all visitors under one roof, those who plan to attend may come with confidence that they will not be left to sleep in the open. Instructions for reservations with be mailed to all members in the course of the next few weeks, together with details of the programme. A general outline of the proceedings already appears elsewhere in this issue.

The Mount Royal hotel will be headquarters for the meeting.

STUDENTS' CONFERENCE

An innovation is scheduled in conjunction with the annual meeting. A representative of the students in engineering from each of the universities in Canada will be invited to a student conference. The proposal was submitted to the undergraduates societies a few months ago, and received unanimous and enthusiastic approval. The students will hold their own conference, before the meeting, in order to discuss the problems common to all universities and to express their opinion on the manner in which the members of the profession can best assist them.

Figures published by the government show that, of all professions, engineering has the strongest appeal to veterans. The tabulation, appearing in another column of this issue giving the registration in the faculties of engineering for the current session, confirms the conclusions of the survey made among the men when they were in the services. Engineering students, now numbering some seven thousand, must constitute a substantial portion of Canadian youth receiving a college education; it is therefore important that their views should be known, that their desires should be formulated.

The Institute is fulfilling one of its most imperative obligations when it thus provides the finances and the inspiration to establish a means of expression for the young men who will constitute the profession to-morrow.

REGISTRATION IN ENGINEERING AT CANADIAN UNIVERSITIES

The New Students and Their Prospects

Each year the *Journal* presents a tabulation of the enrolment of engineering students in Canadian universities. The figures have changed but little from year to year, but, as can be seen readily, it is a different story today. This sudden upswing was not unexpected, and the totals are reasonably close to the earlier estimates made by the deans, but it is still a startling picture.

Veterans Want to be Engineers

The figures, of course, show a new record in every detail. A total enrolment of 7,061 engineers compared to last year's registration of 4,651 is impressive. This increase of 52 per cent gives some picture of the task undertaken by the universities. Add to this the 3,000 who are expected to start after the new year, and you must alter the picture immediately.

University	Year	General Course	Aeronautical Engineering	Agricultural	Ceramic and Non-metallic Minerals	Chemical Engineering and Chemistry	Civil	Electrical	Engineering and Business	Electrical and Mechanical	Forestry	Geology and Mineralogy	Mechanical	Metallurgical	Mining	Engineering Physics	Special (Refresher)	Total
N.S. Tech.	3rd	....	....	....	....	....	21 (2)	23 (1)	....	....	....	....	32 (5)	....	5 (1)	....	....	81 (9)
	4th	....	....	....	....	....	15 (4)	15 (4)	....	....	....	....	15 (2)	....	2 (1)	....	2 (2)	*49 (13)
Total		....	....	....	....	....	36 (6)	38 (5)	....	....	....	....	47 (7)	....	7 (2)	....	2 (2)	130 (22)
New Brunswick	1st	....	....	....	....	....	69 (30)	57 (26)	....	....	....	....	....	....	....	....	....	126 (56)
	2nd	....	....	....	....	....	43 (16)	27 (10)	....	....	....	....	....	....	....	....	....	70 (26)
	3rd	....	....	....	....	....	17 (3)	18 (4)	....	....	....	....	....	....	....	....	....	35 (7)
	4th	....	....	....	....	....	16 (2)	20 (4)	....	....	....	....	....	....	....	....	....	*36 (6)
Total		....	....	....	....	....	145 (51)	122 (44)	....	....	....	....	....	....	....	....	....	267 (95)
Laval	1st	48	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	48
	2nd	....	....	....	....	14	10	20	....	....	....	4	....	....	7	....	....	55
	3rd	....	....	....	....	3	....	18	....	....	....	....	....	....	3	....	....	24
	4th	....	....	....	....	4	....	10	....	....	....	....	....	....	3	....	....	*17
Total		48	....	....	....	21	10	48	....	....	....	4	....	....	13	....	....	144
Ecole Polytechnique	1st	126 (4)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	126 (4)
	2nd	79 (3)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	79 (3)
	3rd	60	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	60
	4th	63	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	63
	5th	....	....	....	....	3	13 (1)	....	....	26 (2)	....	....	....	....	5 (1)	....	....	*47 (4)
Total		328 (7)	....	....	....	3	13 (1)	....	....	26 (2)	....	....	....	....	5 (1)	....	....	375 (11)
McGill	1st	318(168)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	318(168)
	2nd	135 (72)	....	....	....	33 (12)	....	....	....	....	....	....	....	....	10 (4)	11 (6)	....	189 (94)
	3rd	....	....	....	....	27 (5)	42 (19)	42 (12)	....	....	....	....	48 (14)	....	11 (7)	10 (1)	....	180 (58)
	4th	....	....	....	....	24 (4)	20 (4)	26 (1)	....	....	....	....	29 (5)	....	10 (4)	....	....	*109 (18)
Total		453(240)	....	....	....	84 (21)	62 (23)	68 (13)	....	....	....	....	77 (19)	....	31 (15)	21 (7)	....	796(338)
Queen's	1st	350(241)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	350(241)
	2nd	230(112)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	230(112)
	3rd	....	....	....	....	34 (6)	31 (13)	33 (10)	....	....	....	8 (3)	35 (9)	9 (5)	15 (7)	13 (1)	....	178 (54)
	4th	....	....	....	....	22 (1)	12 (4)	22 (6)	....	....	....	9 (1)	37 (6)	8	6 (5)	....	....	*116 (23)
Total		580(353)	....	....	....	56 (7)	43 (17)	55 (16)	....	....	....	17 (4)	72 (15)	17 (5)	21 (12)	13 (1)	....	874(430)
Toronto	1st	....	25 (25)	....	2 (2)	63 (63)	52 (52)	115(115)	....	....	....	11 (11)	67 (67)	9 (9)	21 (21)	27 (27)	....	392(392)
	2nd	....	34 (19)	....	7 (2)	95 (43)	92 (53)	109 (54)	36 (36)	....	....	4 (3)	118 (73)	15 (13)	12 (9)	57 (24)	....	579(329)
	3rd	....	19 (10)	....	4	67 (23)	45 (20)	50 (17)	....	....	....	6 (4)	67 (29)	12 (7)	9 (8)	26 (7)	....	305(125)
	4th	....	11 (1)	....	4 (1)	55 (9)	51 (6)	47 (10)	....	....	....	2	73 (14)	18 (3)	3 (2)	21 (3)	....	*285 (49)
Total		....	89 (55)	....	17 (5)	280(138)	240(131)	321(196)	36 (36)	....	....	23 (18)	325(183)	54(32)	45 (40)	131 (61)	....	1561(895)
Manitoba	1st	285(158)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	285(158)
	2nd	98 (47)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	98 (47)
	3rd	....	....	....	....	....	33 (7)	41 (8)	....	....	....	....	....	....	....	....	....	74 (15)
	4th	....	....	....	....	....	19 (5)	63 (15)	....	....	....	....	....	....	....	....	....	*82 (20)
Total		383(205)	....	....	....	....	52 (12)	104 (23)	....	....	....	....	....	....	....	....	....	539(240)
Saskatchewan	1st	479(263)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	479(263)
	2nd	181 (66)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	181 (66)
	3rd	....	....	11 (2)	8	9 (2)	23 (9)	2	....	....	....	4 (2)	44 (14)	....	....	15 (3)	....	116 (32)
	4th	....	....	2	4	7 (1)	22 (4)	....	....	....	....	3 (1)	52 (12)	....	....	10 (1)	....	*100 (19)
Total		660(329)	....	13 (2)	12	16 (3)	45 (13)	2	....	....	....	7 (3)	96 (26)	....	....	25 (4)	....	876(380)
Alberta	1st	197(157)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	197(157)
	2nd	....	....	....	....	25 (6)	44 (13	55 (21)	....	....	....	....	....	....	18 (9)	....	....	142 (49)
	3rd	....	....	....	....	13 (4)	26 (3)	24 (5)	....	....	....	....	....	....	6 (4)	3	....	72 (16)
	4th	....	....	....	....	28 (1)	18 (4)	29 (9)	....	....	....	....	....	....	6 (1)	3	....	*84 (15)
Total		197(157)	....	....	....	66 (11)	88 (20)	108 (35)	....	....	....	....	....	....	30 (14)	6	....	495(237)
British Columbia	1st	540(324)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	540(324)
	2nd	189 (64)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	189 (64)
	3rd	....	....	....	....	27	17	40	....	....	5	6	32	7	7	....	....	141 (24)
	4th	....	....	....	....	29	15	20	....	....	17	8	37	7	1	....	....	*134 (13)
Total		729(388)	....	....	....	56	32	60	....	....	22	14	69	14	8	....	....	1004(425)

***Indicates those graduating in spring of 1946—Total 1059(180).**

Note—The figures shown in brackets indicate in each case the number of veterans comprised in the figure immediately preceding.

The picture has to be changed even again. The engineering faculties report that next fall there will be another tremendous registration, perhaps the last of the men from the services. Just how they are going to handle this colossal task is not apparent to one outside the academic circles, but there need be no fear that it will not be solved. The deans will meet the situation and will give everyone his chance, without lowering the standards of the profession. Canada is indeed fortunate in the type of men heading its engineering faculties.

The compilation shows some new trends in the choice of courses. Electrical is the most popular, as it was last year, but civil has come ahead of mechanical for the first time in years. Chemical has dropped back to fourth from third and mining follows in fifth place, but much stronger than last year. Of course these positions may be affected radically when the 3,400 students now in their first two years decide which course they are going to follow.

One cannot help but observe the great number of returned men shown in the tabulation (i.e. 3,073) or 43 per cent of the total enrolment. The figures shown in brackets indicate in each case the number of veterans comprised in the figure immediately preceding. The 3,000 additional expected early next year will be mostly returned men, as will the majority of those registered next fall. Engineering seems to have a strong appeal to the young men who have been fighting the war. Perhaps through them engineering can make a contribution to peace, equal to that made through them to war.

It is reported that 60 per cent of all active service personnel expressing a desire to go to a university, indicated engineering or science as the field in which instruction was desired — 50 per cent for engineering and 10 per cent for science. The universities are making a gallant effort to cope with the situation, but it is not easily done. There are shortages of teaching staff, premises, and equipment, but miracles are being performed daily by the deans of engineering and their staffs, so that the situation may be kept in hand. That "Necessity is the mother of invention" is being proven over and over again, and no student will be denied his opportunity if human ingenuity and resourcefulness can prevent it.

Industrial plants, buildings of the armed services, and of many descriptions are being utilized. Equipment from industry, from government, from individuals is being borrowed or bought. Personnel from the forces and from industry is being pressed into service. And with it all there is every evidence that no one is failing to do any part that falls to him. Everyone is determined that no obstacle is going to delay or deny to the returning service man the education that he desires. The writer has visited practically all Canadian universities this year, and this determination to overcome the obstacles has been a most outstanding feature in every instance.

Where Will They Find Work?

The question arises as to what all these engineers are going to do upon graduation. Opinions vary as to the numbers who will not complete the courses, but there is no doubt that within four years there will be a greatly increased production. Today there is still but little unemployment in the profession, but, on the other hand, the unfilled demands of employers can be met readily by a small increase in the supply.

If peacetime industry develops as it is expected it will, there should be a lot of new employment opportunities, to absorb increasing numbers of engineers. This post-war development should uncover new uses for engineers and scientists, particularly if employers are made conscious of the versatility which their training gives them.

Average Age is High

Another factor which should not be overlooked, when contemplating the future, is that in many places the average age of present engineers is very high. Many will be ready to retire, and their places will be available to the younger men. For example, in the case of one of the largest employers of engineers, over 60 per cent of such employees are over forty years of age. A large professional organization reports that the average age of all its members is fifty-three. It is reported that in another society the average age is sixty-two. These figures and many others that are available indicate definitely that there is room for an increasing number of young men.

Opportunities in the U.S.A.

Since Pearl Harbour almost no engineers have been graduated in the United States. All males of 18½ years were inducted into the army or volunteered before that age. Only those rejected on medical grounds were allowed to continue their educations. With a normal graduation of about thirty thousand engineers a year, a tremendous shortage has been brought about by the government policy. At the recent annual meeting of the Engineers Council for Professional Development, it was disclosed that the shortage will be one hundred and fifty thousand before the new classes reach graduation.

This colossal shortage, or "deficit" as it is called in the States, is a certain indication that Canadians will be in demand. Generally salaries are higher there, and if any unemployment develops here, or if salaries are maintained at too low a level, it is just as natural to expect Canadians to cross the border as it is to expect water to run down hill.

Exit Restrictions

For the moment any serious migration is prevented by the exit permit requirements. A Canadian may not go to the States for employment without securing such a permit, and up to the present they are not being given very freely, or without good cause. However, this policy cannot be retained for any great length of time unless some national emergency requires that the individual makes a further sacrifice on behalf of his country. To keep Canadians out of the States for any less reason, providing, of course, that the States wants them, would be difficult to explain or justify.

It would be unfair and unnatural to use this legislation as a means of holding Canadian engineers and scientists in Canada, at salaries that are inadequate or are substantially less than they could receive elsewhere. Canadians won't go to the States if they are treated properly here, and the situation rests entirely with Canadian employers.

A case has come to the attention of the *Journal* where a Canadian, employed by the Federal Government at a salary of $3,300, was refused an exit permit by the government to take a position in the States at $5,000. The exit legislation was never intended for such purposes, and must not be so used. It must not become a weapon to enforce or maintain low wages, for a few notoriously low wage paying employers.

No one wants to see Canadian trained engineers and scientists leave the country. The loss would be serious, but it can be prevented by the employers themselves, without the use of restrictive and unreasonable legislation. No other solution would be satisfactory or acceptable.

It's a Useful Education

After all is said and done, the fact remains that an engineer's training goes a long way towards equipping any person to earn a livelihood. For general purposes, it appears to be the best course, and therefore an engineering graduate is not likely to be any worse off than a graduate of some other course, and certainly will be a lot better off than if he had not gone to university at all.

All things considered, there does not appear to be any reason to worry about the graduates of the future. The big job today is to give them their training, and that task seems to be in competent hands right now.

WAGES FOR PROFESSIONAL WORKERS

The following correspondence requires no explanation. It is part of the Institute's endeavour to secure fair wages for professional employees of the government. It has been approved by Council. The reply from the chairman of the Civil Service Commission is interesting and encouraging.

The difficulty up to now does not seem to be the fault of the Commission. It has admitted for a long time that the present scale was too low — and it is understood that the sub-committee of the Treasury Board reached the same conclusion about three years ago, but the Treasury Board has failed to move. Is there any hope that the Board will be any wiser now? Is the situation now so critical that it will have to be taken seriously?

A lot of permanent damage has been done already, but it may not be too late to save something out of the mess.

Montreal, Nov. 6th, 1945.

The Civil Service Commission,
Ottawa, Ontario.

Re: Wages for Professional Workers

Gentlemen:

For many years The Engineering Institute of Canada has been receiving from your Commission advertisements of positions for which you were seeking candidates. Through our Employment Service we have given these publicity, both by interviews with persons calling at our offices, and by advertisements in *The Engineering Journal*. Over a long period of years we have secured many applications for you. Our object in reviewing the situation now is to cite why we have been unable to secure candidates in recent years.

The remuneration offered is inadequate, and is so far below that offered by private industry that persons are not interested. We are now supplying job opportunities to about twenty men a day, but none look twice at any of the several openings being advertised by the Civil Service. We feel mention should be made also of the fact that present employees of various government departments are coming to us seeking information about opportunities with other employers. With their salary scale before us, it is easy to understand why.

With the government requiring more professional workers, but losing existing employees, it seems apparent that something must be done. The Institute believes that government work is as important as that of private enterprise, and will be glad to aid in securing required staff, but it cannot be of assistance unless competitive wages are offered.

This letter is being writen in the hope that something can be done to rectify a serious situation before an irreparable injury is done to government service and prestige. Engineers *must* be secured to carry out the government programme, but they will *not* be secured at present salaries.

Is an adequate revision of the present salary scale in prospect?

Yours sincerely,

(Signed) L. Austin Wright,
General Secretary.

Civil Service Commission of Canada,
Ottawa, November 17th, 1945.

Dr. L. Austin Wright,
The Engineering Institute of Canada,
Montreal 2, Que.

Dear Dr. Wright:

I wish to acknowledge your letter of the 6th instant with reference to salary rates for professional, scientific and technical workers in the Public Service.

You are probably aware that as long ago as February, 1945, the Commission reported to the Government recommending remedial action in connection with these salary rates and also general conditions of employment and advancement in these technical classes. Only partial approval has been given to the Commission's recommendations and I have recently pointed out to an Interdepartmental Committee and to the Ministers concerned, that further improvement in the situation is necessary if we are going to recruit and retain suitable technical staff to meet Government needs.

I have placed a copy of your letter in the hands of the Secretary of State who is very much interested in the problem and I am in hopes that immediate consideration will be given to the Commission's recommendations which have already been discussed with representatives of the Engineering Institute and of the Professional Institute, and which we feel will meet the needs of the situation to a very great extent.

Yours sincerely,

(Signed) Charles H. Bland,
Chairman.

TEXT FOR C.E.D.

The following editorial appeared under the above title in the October issue of *Mechanical Engineering*, the monthly publication of The American Society of Mechanical Engineers. It is reproduced here, with the kind permission of the editor, in the belief that the message will be equally inspiring to Canadian engineers and industrialists.

The Committee for Economic Development (C.E.D.) was organized a few years ago in the United States, as a private, non-profit, non-political association of businessmen to help stimulate private enterprise to plan realistically for business expansion and greater employment after the war. C.E.D. operates through two main divisions—Field Development and Research. To encourage bold and realistic planning, local C.E.D. committees have been organized and are at work in more than 2,800 communities of 10,000 population or over.

The editorial's condemnation of the ivory tower policy reminds one of the words of the Prime Minister of Canada: "Prosperity, like peace and security, is indivisible."—Editor.

If the Committee for Economic Development are looking for texts to define their purposes and methods, they will find several in the Book of Nehemiah. Mourning in captivity over the desolation of Jerusalem, Nehemiah sought and obtained from King Artaxerxes permission to return to his native city for the purpose of rebuilding its walls. After he had viewed the ruins by night he said to his fellow countryman, "Come, and let us build up the wall of Jerusalem, that we be no more a reproach. . . . . . And they said, Let us rise up and build. So they strengthened their hands for this good work." Then all the people set to work, "every man over against his house," and when their enemies attempted to stop them, part worked while others stood guard. "So built we the wall . . . . for the people had a mind to work."

The walls of our peacetime living have been laid waste and the voice of C.E.D. is the voice of Nehemiah bidding us repair the wall, every man over against his own house. In thousands of communities, coordinated by the studies and activities of the Committee, the work of reconstruction has been made a local affair. The proof of success is yet to come and there will be those who would hinder or divert the workers. But the wall will be built if the people have a mind to work.

Throughout the ages men, viewing the dead ashes of their furnaces and ideologies, have reacted to the stimulus of new ideals that have given them new hope and renewed vigour. Thus Aeschylus, in the trilogy of the Oresteia, brooding over "the ancient blinded vengeance and the wrong that amendeth wrong," and seeking a way out of the tangled events of bloodshed and madness that, according to Greek thought, must inevitably flow out of the sacrifices by Agamemnon of his daughter, turned to "Zeus, whate'er He be," and wrote:

> "Zeus the Guide, who made men turn
> Thoughtward, Zeus, who did ordain
> Man by Suffering shall learn.
> So the heart of him, again
> Aching with remembered pain,
> Bleeds, and sleepeth not, until
> Wisdom comes against his will.
> 'Tis the gift of One by strife
> Lifted to the throne of life."

So also Western Europe, recovering from the spiritual and economic oblivion of the Dark Ages, flowered into a resurgence of enterprise and culture animated, as Henry Adams shows, by adoration of the Virgin. The extraordinary cathedrals built to the glory of the power she personified stand to-day as witnesses of its hold over the men of those times.

Nor is our own history without its testimony of men who discovered powers greater than their own that sustained their pioneering spirit in the New World. The only miracles they experienced were those wrought within themselves. By energy and fortitude they accomplished the task before them, "for the people had a mind to work." So also they founded a Republic, established the arts of agriculture, commerce, and industry, fostered the spirit of independence and liberty, made progress toward the principle of equal opportunity for all, and built up a Mecca for the oppressed peoples of the earth who wished to share the advantages and the manner of life that had here been set up. More blatantly advertised than intelligently comprehended in later years, their ideals of democracy have since flourished in a land rich in resources and opportunity and isolated by distance, indifference, and self-satisfaction against the ideologies, old and new, of other portions of the globe.

Two world wars and a depression have changed all that. The vigorous and immature Republic of the West has emerged as the world's strongest and wealthiest nation, untouched by the material destruction that has been visited upon large areas of the world, envied or hated by many peoples who must look to her for leadership and example. On her more than on any other nation rests the responsibility of maintaining the peace of the world, of binding up its wounds, and of leading men into pathways of hope, of opportunity and personal security, and of better modes of living.

How shall we prepare to do what lies before us? Surely not by building physical walls as did the citizens of Troy and Jerusalem, nor by erecting those figurative walls of selfishness and indifference that shut out more than they shut in. The walls we build must encompass all races and all peoples for common defence against the evils that have plagued mankind since the beginning of time. As the C.E.D. has shown by its method of local attack worked into a national programme, the place for everyone to begin to build these walls is over against his own house.

Our problem is greater than the national and material one to which the C.E.D. must obviously limit its leadership. What shall it profit us if we achieve the wonders we have planned and give little thought to the rest of the world? Shall we do nothing to dispel the suspicion or to remove the causes of hate and envy? Shall we do no more than our legal commitments demand to avert the utter destruction of civilization another war would probably bring about, or to counteract what appears to be a trend toward serfdom?

The regeneration of inner power may be called mysticism by some hard-headed folk, but faith in it is more potent to aid men in what they have to do than the starkest kind of realism has ever done. Men call it by different names, but engineers recognize one phase of it in the fructifying force of scientific knowledge. It was Pallas Athena, Goddess of Counsel, who, in the third drama of the trilogy, broke the power of the Furies and rescued Orestes from his madness. So in a modern sense, Science may save the world from its madness if men who love the truth are sufficiently stirred by their convictions to let Science do for us what it will. Then it may be said of us, "So built we the wall, for the people had a mind to work."

THE CANADIAN CHAMBER OF COMMERCE AND THE INSTITUTE

The recent appointment of Past-President John Bow Challies as Chairman of the Executive Committee of the Canadian Chamber of Commerce will be welcomed by all who know him, and particularly by members of the Institute when they recall the many notable services which he rendered during his term of office in 1938. His achievements in the conservation and use of the water powers of Canada were fittingly recognized in that year, when his *alma mater*, the University of Toronto, conferred upon him the honorary degree of Doctor of Engineering. After some twenty years of engineering work in the service of the Federal Government, he joined the staff of a great hydro-electric enterprise, of which he is now one of the vice-presidents. His experience as an executive officer of the Shawinigan Water and Power Company rounds out a course of professional training which gave unusual opportunities to an able man, requiring, as it must have done, the solution of a host of problems in administration, organization, finance, and engineering, which in many cases had Dominion-wide or even international aspects.

J. B. Challies, M.E.I.C.

In this connection it is of interest to note the part which the Canadian Chamber of Commerce is taking in dealing with many of the pressing questions of the day. The Chamber is a federation of more than one hundred and fifty Boards of Trade and Chambers of Commerce, located in every province of the Dominion. It has the support of trade and professional associations, agricultural organizations, and over five hundred business enterprises in the fields of finance, commerce, and industry. Thus, in Canada's economic life, business is enabled to meet its own and the country's problems with a well directed and united effort. The Chamber is in fact a force making for national unity. But this is not all. Through its membership in the Federation of Chambers of Commerce of the British Empire, it helps in developing closer relations with the Commonwealth as regards economic matters.

The activities of the Canadian Chamber of Commerce are carried out in accordance with a programme whose general features are decided by the membership at its annual meeting. The work is directed by a National Board which includes the President, the members of the resident Executive Committee, nine Vice-Presidents (one from each province), and nine National Councillors (one from each province). There are six service departments, and two regional offices, in addition to the national Secretariat.

The resident Executive Committee—appointed by the National Board of Directors—carries on the ordinary business of the corporation during the intervals between the meetings of the National Board. Various standing and special committees appointed by the Annual Meeting report or make recommendations regarding such matters as international and interprovincial trade, immigration, transportation, agriculture, labour-management collaboration, equitable taxation, the promotion of private enterprise, and other pertinent questions.

There are four classes of membership in the Canadian Chamber of Commerce, namely, Organization Members (Boards of Trade, Chambers of Commerce, and national trade, business and professional associations), Individual Members (persons associated with the business life of Canada), Associate Members (firms and corporations contributing moderate membership fees) and Patron Members (firms and corporations associated with the business life of Canada who support the work of the Chamber by more substantial contributions). The National Board of Directors has power to add to its membership such representatives as may be nominated at its request by trade, business and professional associations which are Organization Members. The Engineering Institute of Canada is one of these. Our present representative is Past-president Arthur Surveyer.

Two Regional Committees of the National Board of Directors, functioning in Ontario and British Columbia respectively, are in charge of a Regional Secretary, and aid in carrying on the promotional, educational, and public relations activities of the Chamber. The Chamber publishes a national magazine, *Canadian Business*, to interpret its policy to members and the public.

The main objects of the Canadian Chamber of Commerce, as set forth in its By-Laws, are to promote a vigorous Canadian national sentiment, to increase the usefulness of the local Boards of Trade and Chambers of Commerce and encourage their united action, and " especially to secure and present an informed opinion so as to obtain the proper and careful consideration of questions pertaining to the economic, financial, commercial, industrial, and agricultural interests of the country ". The Reports of the Chamber to its members show a full appreciation of the critical economic phase through which we are now passing. They indicate that its long range programme is to work " for a free competitive economy and the preservation of representative democracy ", a private enterprise system wherein there will be a proper balance between government regulation and the free play of individual effort. Wartime labour relations have received the attention of several committees, and the Chamber is represented on the Wartime Labour Relations Board (National). A delegation from the Chamber attended an Empire Chamber of Commerce Conference held in London in October 1945, the conclusions and results of which will shortly be reported to the membership.

It is obvious that many of the subjects and problems dealt with by the Chamber are of interest to Institute members. Accordingly, we find the engineering profession well represented among the active committees of the Chamber. With Dr. Challies on the Executive Committee are Col. R. D. Harkness—one of the Vice-chairmen—and Dr. Surveyer—nominated Beique, R. E. Stavert, and H. G. Welsford. Dr. Surveyer is chairman of the Chamber's Post-War Planning Committee. Mr. Paul Sise is serving on the Foreign Trade Bureau, whose delegates have been engaged as opportunity offers in discussing trade problems with the Department of Trade and Commerce in Ottawa, in attending national and international conferences, and in directing the Chamber's commercial intelligence work.

It is a matter for congratulation that so many members of The Engineering Institute of Canada are taking part in national work of this kind, in which their professional training enables them to give valuable advice. In the past we have seen too many instances in which projects, sometimes of considerable magnitude and involving the large expenditure of public money, have been put in hand and completed when any competent engineer could have pointed out their unsoundness from the economic or financial point of view. But in such cases engineers have too often been called in only at the later stages for advice on design, construction, or other purely technical matters, and have not been consulted on any points involving financial or industrial consideration. Changes in such schemes during actual construction have in some cases caused the final cost to rise far beyond the original estimates.

The appreciation of engineers' capabilities by organizations like the Canadian Chamber of Commerce will be helpful in changing this state of affairs. Is it too much to hope that in future those responsible for directing and financing the early stages of schemes involving engineering work will take engineers' advice at the commencement as well as in the later phases of the development of important enterprises?

CORRESPONDENCE

London Letter

Khaki University of Canada,
Canadian Army Overseas,
November 2nd, 1945

General Secretary,
The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal, Que.

Dear Sir:

You may be interested in a few recent events in the engineering world here.

On October 11th there was a very interesting meeting at the Institution of Electrical Engineers whereat four papers on the effect of weather on power transmission were given. The meeting was a joint one with the Meteorological Society. Two papers were by members of the Institute and two by the meteorologists. The first dealt with the effect of temperature on load; the second with frost, snow and rain effects on transmission lines; the third dealt with the effect of storms and mean arithmetic weather conditions; and the last with methods of weather forecasting, stressing the applications of the radiosonde. Following this, a discussion took place which was intensive and instructive.

The only dangerous conditions in this country are those where ice forms on the lines and where heavy off-track tropical storms accompanied by strong winds cause electric breakdowns or structural failure.

The galloping of transmission lines was discussed, its presence being denied by two engineers as optical illusions! However, tribute was paid to Canada for the pioneer work in the study of this phenomenon by the author.

An interesting three dimensional chart of weather-load-sunshine relations was demonstrated, the exact details of which at the moment escape me.

This week a building industries' congress was held at Central Hall, Westminster. The relations of the building industries and labour were discussed. Town and country planning was the only session I could attend. Here, Lewis Silkin, the new minister of Town and Country Planning, offered some pertinent suggestions to planners. However, during the discussion following the speech, a number of delegates related their experiences in trying to induce the government to approve their plans for expansion. One town near Manchester has been trying to have its plan approved for some 20 odd years with no results so far. (Sounds familiar!) The R.I.B.A. came in for serious criticism as they had laid out a plan for improving London without gathering data beforehand as to its suitability.

Some interesting points were brought out. Build with native materials. Build for all community groups, not just one group. For example, if a scheme is put forward for the labouring group with no provision made for the white collar worker, that scheme is doomed to failure.

A councillor from Islington, a London suburb, brought up the question of awarding damages to owners for property pulled down to make way for a project. He also pointed out that the density of population in Islington is 211 persons per acre while a recent plan recommended not more than 126. " Where," asked the councillor, " shall we put the 85 people left over? "

I hope to visit the Institution of Civil Engineers and the Mechanical Engineers at least once before Christmas and I shall try to pass on a better summary of the meetings. The ones above have been quoted from memory.

Sincerely,

(*Signed*) A. C. Davidson (Lieut.) R.C.E.,
M.E.I.C.

60TH ANNUAL GENERAL AND PROFESSIONAL MEETING

THE ENGINEERING INSTITUTE OF CANADA

MONTREAL

THURSDAY AND FRIDAY
FEBRUARY 7 and 8 - 1946

Headquarters - - - MOUNT ROYAL HOTEL

Preliminary Programme

THURSDAY, FEBRUARY 7th

(a.m.)

Annual Business Meeting.

Evaluation of Light Metal Alloys:
J. A. Van den Broek, University of Michigan.

Luncheon

An Address on Engineering Education

(p.m.)

Rolls-Royce Gas Turbines:
J. D. Pearson, Rolls-Royce Ltd., Montreal.

(Evening)

Montreal Branch Annual Smoker.

FRIDAY, FEBRUARY 8th

(a.m.)

The Future of Radio Communications in Canada:
A. B. Hunt.

The Winter Temperature Cycle of the St. Lawrence Waters — A Plea for More Data:
J. G. G. Kerry.

Luncheon

An Address on Reconstruction Work

(p.m.)

Civil Aviation:

(Evening)

Dinner.

British War Achievements in Electrical Engineering:
P. Dunsheath, President of the Institution of Electrical Engineers (Great Britain).

Dance.

IT IS WISE TO MAKE RAILWAY RESERVATIONS NOW!
INSTRUCTIONS FOR HOTEL RESERVATIONS WILL BE MAILED SOON

Complete programme will appear in January Journal

INTERNATIONAL ENGINEERING CONGRESS

To Be Held in Paris Next June

Recently the preliminary programme for an International Engineering Congress to be held in Paris, June 17 to 22, 1946, has arrived at Headquarters. The meeting is sponsored by a committee representing engineers from Great Britain and several European countries. It was originally set up over a year ago for the purpose of establishing an International Federation of Engineering and Allied Institutions. It is proposed to discuss such a project during the congress. It is reported that the sponsors have received already promises of participation and financial support from several engineering societies on the Continent.

Members of the Institute who may be interested in taking part in the congress are requested to communicate with Headquarters so that their names may be passed on to the committee. The preliminary programme follows:

A.—General aspects of technical problems in connection with world reconstruction and development.

1. Damages caused by the war. Immediate technical problems connected with economic recovery and reconstruction.
2. Long term plans for reconstruction and development; national, and provincial. The place of engineering in the planning and realization of such projects.
3. Industrial research. Patents. Relations of engineering societies with universities and research organizations.

B.—Present engineering techniques in the world.

Under this heading it is proposed to have general outlines presented of work done by international organizations such as the Large Power Systems Conference, World Power Conference, International Standards Association, etc., in the following branches:

1. Management; 2. Standardization; 3. Physical planning; 4. Architecture: housing; 5. Public works and civil engineering; 6. Power; 7. Transport; 8. Raw materials; 9. Agriculture; 10. Industry; 11. Transmission; 12. Distribution.

C.—Engineers and technicians in the world.

It is proposed to have papers presented by representatives of national societies of engineers and technicians, or individually, on the following subjects:

1. Obligations and rights of engineers and technicians.
2. Role of engineers and technicians in international organizations dealing with reconstruction and development.
3. Social functions of engineers and technicians.
4. Technical education and professional training.
5. Means of facilitating exchanges of engineers and specialists between various countries.

MEETING OF COUNCIL

A regional meeting of the Council of the Institute was held at the Hotel Saskatchewan, Regina, on Saturday, November 17th, 1945, convening at two o'clock p.m.

Present: President E. P. Fetherstonhaugh (Winnipeg), in the chair; Vice-President R. A. Spencer (Saskatoon); Councillors H. L. Briggs (Winnipeg), C. W. Carey (Edmonton), J. W. D. Farrell (Regina), representing the Saskatchewan Association, J. McMillan (Calgary), J. McD. Patton (Regina), P. M. Sauder (Strathmore), representing the Alberta Association, J. A. Vance (London), and General Secretary L. Austin Wright.

There were also present by invitation—Past-Councillor L. A. Thornton, Regina; A. T. McCormick, secretary-treasurer of the Winnipeg Branch; F. E. Estlin, vice-chairman, D. W. Houston, secretary-treasurer, Stewart Young, past-councillor and immediate past secretary-treasurer, F. C. Christie, W. O. Longworthy and H. L. Roblin, members of the executive of the Saskatchewan Branch.

In welcoming the councillors and guests, the president expressed his gratification at the number of councillors present, almost twice as many as required for a quorum. He hoped that all guests would feel free to express their views on any matters that came up for discussion, although any formal vote would have to be confined to councillors. Following the usual custom, each person present introduced himself.

The minutes of the meeting held on October 6th, 1945, were taken as read and approved.

Death of Councillor William Meldrum: The president announced the death of Councillor William Meldrum, in Lethbridge on November 7th. Mr. Meldrum had been a Corporate Member of the Institute for over twenty years, and had represented the Lethbridge Branch on Council for the years 1944-1945.

On the motion of Mr. Carey, seconded by Mr. Sauder, it was unanimously resolved that the sympathy of Council be recorded in the minutes as follows:—

"The Council of The Engineering Institute of Canada has learned with regret of the sudden death of William Meldrum, its councillor from Lethbridge. The general secretary was instructed to write Mrs. Meldrum and express to her the sympathy of the president and Council of the Institute."

Rehabilitation of Members in the Armed Forces—The general secretary gave a general outline of the rehabilitation work which has been accomplished up to the present time. For complete details, he referred councillors to the October issue of the *Journal.* He emphasized the appreciation which had been expressed by members in uniform, even from many who did not require any service. He believed that, from every point of view, this was one of the most satisfactory and useful services that the Institute had been able to render.

Mr. Wright spoke very highly of the work done by Major D. C. MacCallum, the rehabilitation officer. Major MacCallum had tackled the job with a great deal of enthusiasm and energy, and had accomplished a great deal in a short period of time. He pointed out also that the number of placements indicated in the general report had been doubled since the report was issued. He explained that it was impossible to know the correct number of placements, as both employees and employers frequently forgot to report back after employment had been arranged. Several questions were asked about details of the service relating to the contact of the branches with Major MacCallum.

Community Planning—The general secretary reported that Ross L. Dobbin of Peterborough had accepted the chairmanship of the Institute's Committee on Community Planning. This was received with general approval, and a motion appointing Mr. Dobbin to that position was approved unanimously.

Harry Bennett Memorial Fund—Mr. Vance, chairman of the committee, reported in detail the progress which has been made up to date. He presented an interim report from the committee, and asked Council to consider it item by item. In this manner, each item was approved unanimously.

There was some discussion as to the correct title for the fund, it being suggested that it might be the "Harry S. Bennett Educational Fund of The Engineering Institute of Canada", or "The Educational Fund of The Engineering Institute of Canada to Commemorate the Memory of Harry S. Bennett". It was pointed out that the latter title might be better from the point of view of obtaining tax exemption for contribution, but upon a motion it was agreed that the first title was more suitable.

As the present purpose of the fund was to provide loans to worthy students, Dean Spencer pointed out that in the province of Saskatchewan there had been little need for such funds within recent years. The government had shown a willingness to assist worthy students, in addition to which the economic condition of parents made loans less essential than at other times in the past.

Mr. Vance made a note of this observation, and pointed out that the fund might be of assistance to first year students, to whom, ordinarily, loans or other financial assistance were not readily available. He reported that the committee would investigate this situation thoroughly before making a final report. He emphasized also the need of the Institute retaining power to revise the purposes of the fund as conditions surrounding educational matters change. For instance, the time might come when loans would be entirely unnecessary. Under such circumstances, the fund could be used for scholarships, lectureships, or other purposes relating to engineering education.

The question was also raised as to whether money would be available to finance post-graduate study. Dean Spencer was particularly interested in this prospect, as he favours encouragement being given to outstanding scholars to go on with advanced studies. Mr. Vance replied that such a purpose would readily come within the terms of reference of the Board in administering the fund, the only limitation being the total amount of money available.

Mr. Carey approved of the loaning principle rather than the granting of scholarships, as in this way students could return the money borrowed, and would not feel that they had been accepting charity.

Mr. Vance consulted the Council as to the best means of informing the membership of the establishment of the fund, and means of obtaining contributions to it. Mr. Patton stated that *The Engineering Journal* should be the best medium, and he thought that if the full story were told in it the desired results would be obtained.

Mr. Roblin suggested that the fund might be used as a basis of security with the bank, so that students could borrow direct from the bank. In the discussion which followed there were some criticisms of such a procedure, but Mr. Vance stated that the proposal would be discussed by the committee.

Unanimous approval was given to the draft of all clauses as a basis of preparation of a final report to be submitted to a subsequent meeting of Council.

Membership Committee—The general secretary outlined the proposal of the Membership Committee relating to the admission and transfer of members. He explained that the final wording of the proposed by-law amendments was not yet prepared, but that the principles involved were as follows:—

1. All Students who had been graduated from a recognized college would be transferred automatically to Junior on the second January after graduation, without payment of a transfer fee.
2. Juniors transferring from Students would have the privilege of applying for transfer to Member, any time within the first five years of their Junior membership, and, if their application is approved by Council, they would be transferred, without payment of a transfer fee. Juniors not applying for transfers within the five year period would be subjected to the five dollar transfer fee, and every case beyond the five year term, would be reviewed annually, by Council, for action.

   In both 1 and 2 above, non-graduates would be required to write examinations, in accordance with the by-laws.
3. An Admissions Committee to be established to examine all applications for admission and transfer before presentation to Council. Council still reserves the right to make the final decision, but it is expected that the committee will become expert, and its judgment will be accepted by Council. It is proposed that each member of the committee serve five years, with one new member coming on every year, and one retiring. In this way, it is believed a uniformity of evaluation of qualification can be obtained, that will be more satisfactory than the present method. It is intended that branch executives will still be consulted for all transfers and admissions.

After considerable discussion, it was moved, seconded and approved unanimously that the by-laws be drafted in accordance with the preliminary report, and submitted to the membership.

"*Mulberry*" *Exhibition*—The general secretary reported that the War Office model of the Mulberry project was now showing in Toronto. He reported the statistics as to attendance, which indicated that the Exhibit was a great success.

Committee on Employment Conditions—A report from Mr. Heartz, dealing with a specific action, was reported, and Council's approval requested. Mr. Heartz reported that, in accordance with instructions of Council, he and Vice-President Gage had interviewed the president of a company of which complaint had been made by two members of the Institute, with regard to their treatment in the matter of salaries. He reported that they had been well received, and that the president had expressed genuine appreciation of their interest. A letter in confirmation of the interview was submitted to Council and was approved unanimously.

Council expressed appreciation of the work done by the Committee on this case. It was suggested that this was perhaps the most effective way of obtaining salary adjustments where they were justified. Mr. Briggs reported that in the City of Winnipeg a Commission had been appointed to study engineering appointments on the city staff. This Commission had adopted a job classification which had been accepted by the City. He undertook to secure a copy of the classification for the information of the Institute's Committee on Employment Conditions.

Proposal to Increase Fees—A report from the Finance Committee, which recommended changes in the by-laws involving fees, was presented in full and approved unanimously for ultimate presentation, by ballot, to the membership.

Mr. Armstrong, chairman of the committee, reported that as the result of the canvass made of branch executives, the Finance Committee was presenting its recommendations. These included an increase of five dollars in the annual fee for Member and Affiliate, a two-dollar increase for Juniors but no change for Students. The *Journal* subscription for non-members is to become four dollars per year instead of three dollars.

The Committee also recommends that Life Membership be made automatic to all persons with thirty-five years of Corporate Membership or thirty years of Corporate Membership and age seventy.

The recommendations include also revision in the basis for compounding fees, and some change in the by-law referring to branch rebates, whereby branches would not suffer any loss of income when changing from one rebate percentage to the next.

All these changes were discussed in detail, and general approval given for final submission to the membership. Mr. Patton inquired as to the situation in provinces where the Institute has a cooperative agreement, to which the general secretary replied that the Finance Committee recognized the need of discussing the changes with the associations before a final figure was arrived at for those provinces. Mr. Young suggested that there might be a conference between the Institute and the associations to settle this and other related points. This proposal was well received.

The discussion included several questions with regard to the various additional services for which the increased revenue was required. In this connection, special interest was shown by Messrs. McMillan, Spencer, Carey, Sauder and Briggs.

Mr. Christie referred to the finances of the Saskatchewan Association, and to the increase in the Association's fee. He was of the opinion that if the membership in Saskatchewan was fully informed of the purposes for which the increase was required, a satisfactory response would be received.

Dean Spencer emphasized the service which a full-time field secretary could render in the western provinces. He referred, in particular, to the matter of salaries in the Civil Service. He thought that a field secretary, who could devote adequate time to such a project, might be of great assistance in Saskatchewan and other provinces in securing an improvement in conditions.

Board of Examiners and Education—A report from the Board of Examiners, under the chairmanship of Professor R. DeL. French, was presented. This report recommended that the Institute change its procedure with regard to examinations for admission and transfer, and that instead of the present elaborate set-up, the Institute should recommend to applicants who would be required to write an examination, that they apply for membership in the professional association of the province in which they resided. This report was presented originally at the October meeting of the Council in Windsor, and was approved unanimously, but was being presented again at the Regina meeting for the information of the western councillors. Unanimous approval was given to the proposal.

Annual Meeting 1946—The general secretary reported that since the last meeting of Council consideration had been given to changing the dates for the annual meeting, in the hope of securing better hotel and transportation accommodation. However, after the study of the possibilities, it has been agreed that the original dates be adhered to, namely February 7th and 8th, at the Mount Royal Hotel, Montreal, the formal meeting to be called for January 31st, in Montreal, and adjourned to February 7th. It was moved, seconded and agreed unanimously that these dates be approved.

Planning for Ottawa Federal District—A résumé was given, by the general secretary, of Council's interest and action on the matter of the appointment of Mr. Jacques Gréber, by the Prime Minister, to do the planning of the City of Ottawa as a national war memorial. A telegram sent by the committee appointed for the purpose by Council was presented, together with the reply that had been received from the Prime Minister. Both communications are reproduced in the minutes of the October meeting of Council.

The general secretary reported on further moves that were now under way, upon which no conclusive information was yet available. Approval was given to the action up to date, and the matter was left with the committee for further investigation.

Government Housing Scheme—This subject had been raised at previous meetings by Vice-President Armstrong, and Council had agreed to the appointment of a committee to study the subject and see what interest the Institute should take in it. Mr. Armstrong now recommended the appointment of J. G. Chenevert, H. Massue, and J. L. E. Price. This was approved unanimously.

Report of Nominating Committee—R. L. Dunsmore, chairman of the Nominating Committee, reported that G. L. Macpherson had been nominated by the Sarnia Branch for councillor for 1946. This was accepted by Council.

Councillor for Sarnia Branch: It was moved, seconded and unanimously approved that G. L. Macpherson be appointed councillor for the Sarnia Branch for the balance of 1945.

Councillor for Lethbridge Branch: It was unanimously resolved that C. S. Donaldson be appointed councillor for the Lethbridge Branch to complete the unexpired portion of the term of the late William Meldrum.

Polish Engineers: A letter was presented from the secretary-treasurer of the Montreal branch, inquiring as to future policy with regard to Polish engineers. Up to the present, the Montreal Branch had carried eighty-five of these gentlemen on its mailing list, and now that the war is over the branch suggests a change in procedure, but before taking action desires to have Council's opinion, particularly in view of the fact that similar privileges are made available at other branches.

After some discussion, it was unanimously agreed that the privileges extended to Polish engineers be withdrawn as of January 1st, 1946.

Voluntary Assessment: On the recommendation of the Finance Committee, it was unanimously resolved that the voluntary assessment adopted last year for the support of the rehabilitation activity, be continued for 1946 under the title of " Voluntary Contribution ".

Joint Finance Committee in Alberta: On the motion of Mr. McMillan, and seconded by Mr. Carey, it was unanimously resolved that J. M. Campbell and J. M. Davidson be appointed as the Institute's representatives on the Joint Finance Committee in Alberta, for the year 1946.

Julian C. Smith Medal:. The president appointed Messrs. Vance and McMillan as scrutineers to open the ballot for the Julian C. Smith Medal. Mr. McMillan reported, on behalf of the scrutineers, that all ballots had been canvassed, and that both candidates, George A. Walkem of Vancouver, and Alexander Grant of St. Catharines were successful. It was therefore moved, seconded and unanimously resolved that the Julian C. Smith Medal be awarded to each of these gentlemen; that the scrutineers be thanked, and that the ballot papers be destroyed. Council sent its congratulations to both gentlemen.

Engineers' Council for Professional Development: It was agreed unanimously that the Institute should invite the Engineers' Council for Professional Development to hold its next annual meeting in Canada.

Dr. C. J. Mackenzie, one of the Institute's representatives on the Council of E.C.P.D., submitted his resignation inasmuch as he had been unable to attend any meetings. This was accepted with regret.

It was agreed that the revision in the Canons of Ethics, as prepared by Mr. Singstad of the American Society of Civil Engineers, should be submitted to the Institute's Committee on Ethics. The general secretary reported that at the annual meeting of E.C.P.D. this matter had been discussed in detail, and it was noted that some of the societies had preferred Mr. Singstad's revision to the original.

The Engineer in the Civil Service: The general secretary read a letter which had been addressed to the chairman of the Civil Service Commission, which stated that the Institute Employment Service was unable to secure candidates for Federal Government positions at the existing rates. The letter stated also that before suitable candidates could be secured the rates would have to be put on a competitive basis with other employers. Council approved of the action which had been taken.

Montreal Branch By-Laws: It was agreed that the revised draft of the by-laws for the Montreal Branch should be referred to the December meeting of Council, which was to be held in Montreal.

Corporation of Professional Engineers of Quebec: Council noted that the Corporation of Professional Engineers of Quebec was celebrating its twenty-fifth anniversary this month. The president expressed his regret at being unable to attend the anniversary function in Montreal, but announced that he had arranged for Vice-President Armstrong to represent him.

Committee on Engineering Education: The general secretary reported that certain members of the Institute had suggested that it might be an appropriate time for the Institute to establish a Committee on Engineering Education. The president stated that he appreciated the seriousness of such a question, but that he felt he had not had adequate time to think it out from the point of view of the Institute.

Dean Spencer referred to the many proposals that are being made about revising the curriculum so that more of the humanities could be included. He stated that all deans of engineering were fully aware of the situation, and had been studying it for many years. He questioned whether or not an Institute committee would be helpful at the present time. He did suggest, however, that the matter should be given further consideration, and made certain proposals as to procedure. These were approved by the meeting.

Quebec Applications: At the September meeting of Council, a number of applications from non-graduates in the Province of Quebec, had been referred to a special committee for investigation and report. The recommendations of the committee were presented and accepted,.

A resolution of thanks and appreciation to the officers and members of the Saskatchewan Branch for the splendid hospitality extended to the president and members of Council was passed unanimously.

It was decided that the next meeting of Council would be held in Montreal on Saturday, December 15th, 1945, at nine thirty a.m.

There being no further business, the Council rose at six o'clock p.m.

ELECTIONS AND TRANSFERS

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

Members

Frattinger, Peter Anthony, B.A.Sc. (Univ. of British Columbia), plant engr., Pacific Mills Limited, Ocean Falls, B.C.

Hediger, Louis, graduate (Technical College, Zurich-Winterthur, Switzerland), acting supt. of operation and mtce., Shawinigan Water & Power Co., Victoriaville, Que.

Kilborn, Roland Kenneth, B.Sc. (Queen's Univ.), mech. supt., McIntyre Porcupine Mines, Schumacher, Ont.

Laurie, E. Stuart, B.Eng. (Mech.), (McGill Univ.), engr., Laurie & Lamb, Montreal, Que.

MacKay, Frank Hamilton, B.Sc. (Elect.), (Univ. of Manitoba), asst. engr., Great Lakes Power Co., Ltd., Sault Ste. Marie, Ont.

McKeever, James Lawrence, B.A.Sc. (Elect.), (Univ. of British Columbia), genl. engr., Canadian General Electric Co., Peterborough, Ont.

Narsted, John, genl. supt. and chief engr., Canada Cement Co., Montreal, Que.

Old, Frank John Archbold, engr., River St. Lawrence Ship Channel, Department of Transport, Montreal, Que.

Smith, Robert Francis Alexander, B.Sc. (Mech.), (Univ. of Sask.), B.Sc. (Elect.), (Univ. of Manitoba), refinery mgr., British American Oil Co., Ltd., Montreal East, Que.
Smith, Robert W., Lieut., R.C.E., B.S. (Elect.), (Univ. of New Brunswick), P.O. Box 206, Gagetown, N.B.
Southmayd, Charles Goodrich, B.A.Sc. (Univ. of Toronto), sales engr., Canadian Allis Chalmers Limited, Toronto, Ont.
Wheelwright, Barton, M.E.E. (Harvard Univ.), system chief engr., Canadian National Railways, Montreal, Que.

Juniors

Berry, William Murray, B.Sc. (Civil), (Univ. of Manitoba), jr. engr., Prairie Farm Rehabilitation Administration, Regina, Sask.
Edgeworth, Thomas George, F/O, R.C.A.F., B.Sc. (Chem.), (Queen's Univ.), Moncton, N.B.
Harrington, John Metcalfe, B.Sc. (Chem.), (McGill Univ.), research chemist, Aluminum Co. of Canada Ltd., Arvida, Que.
McDermott, Arthur Gregory Paul, B.Sc. (Elect. Engr.), (Univ. of New Brunswick), asst. construction engr., New Brunswick Telephone Co., Saint John, N.B.
Smith, Edward Stanley, Lieut. (E), R.C.N.V.R. (Univ. of Sask.), Saskatoon, Sask.

Transferred from the class of Junior to that of Member

Brooks, Joseph Warren, B.Sc. (Civil), (Queen's Univ.), engr., Hyatt Bros., Construction Co., London, Ont.
Cape, John Meredith, graduate (R.M.C.), director, E.G.M. Cape & Co., Montreal, Que.
Diggle, William Marvin, B.Sc. (Civil), (Univ. of Sask.), F/L R.C.A.F., Halifax, N.S.
Miles, Charles William Edmund, graduate (R.M.C.), mtce. engr., Imperial Oil Limited, Montreal, Que.
McKee, Gordon Hanford W., B.Eng. (Chem.), (McGill Univ.), instructor in business administration, Univ. of Western Ontario, London, Ont.
Phillips, Frederick Rene, B.Eng. (McGill Univ.), asst. project engr., Canadian Industries Limited, Montreal, Que.
Phillips, Robert Weston, B.Eng. (Mech.), (McGill Univ.), sales and service engr., Bailey Meter Co. Ltd., Montreal, Que.
Walkem, Richard, Major, graduate (R.M.C.), Vancouver Machinery Depot, Vancouver, B.C.
Woolsey, John Townley, Major, graduate (R.M.C.), Canadian Armament Research and Development Establishment, Valcartier, Que.

Transferred from the class of Student to that of Member

McGregor, Leslie Stewart, B.Eng. (Mech.), (McGill Univ.), engr., Dept. Research and Development, C.N.R., Montreal, Que.

Transferred from the class of Student to that of Junior

Brown, James Alexander, Lt. (E), R.C.N.V.R., B.Sc. (Mech.), (Queen's Univ.), C.F.M.O., London, S.W.1, England.
Cumming, Edwin Keith, Lt. (E), R.C.N.V.R., B.Eng. (McGill Univ.), F.M.O., Halifax, N.S.
Douglas, Lloyd Robert, B.Sc. (Elect.), (Univ. of Man.), 192 Hunter St., W., Peterborough, Ont.
Hall, Gordon Hudson, B.Sc. (Elect.), (Queen's Univ.), student, Radio College of Canada, Toronto, Ont.
James, Lourimer, B.A.Sc. (Toronto Univ.), sales engr., Reudel Machinery Co., Toronto, Ont.
Magnan, Maurice, B.A.Sc. (Ecole Poly.), engr., St. Clair Processing Corp., Sarnia, Ont.
MacVannel, Duncan Pine, Lt. (E), R.C.N.V.R., B.A.Sc. (Univ. of Toronto), R.M.C.S. "Protector", Sydney, N.S.
Mitchell, John Hugh, B.Sc. (M.E.), (Univ. of Sask.), refrigeration engr., Canadian Westinghouse, Hamilton, Ont.
Morison, George Alfred, Lieut., B.Sc. (Univ. of Man.), No. 1 C.I.T.R., Canadian Army Overseas.
Norton, Harold A., Engineer Officer, R.C.N.V.R., B.Eng. (Chem.), (McGill Univ.), c/o F.M.O., Halifax, N.S.
Nutter, James Ryan, Lieut. (E), R.C.N.V.R., B.Eng. (Civil), (Nova Scotia Tech. Coll.), H.M.C.S. "Shelburne", c/o F.M.O., Halifax, N.S.
Shaw, Douglas Thomas, Captain, B.Eng. (McGill Univ.), Dept. National Defence (Army), Ottawa, Ont.

Admitted as Students

Audy, Rene (Laval Univ.), 57 Lasot Ave., Quebec, Que.
Bailey, Robert Thomas (McMaster Univ.), Dundas, Ont.
Gans, Nathan, B.Eng. (McGill Univ.), transformer engr. and cost estimator, Bepco-Canada, Montreal, Que.
Kennedy, Gerald Wilfred, B.Sc. (Mech. Engrg.), Nova Scotia Tech. Coll., telephone engr., Northern Electric, Montreal, Que.
Palmer, John Douglas, B.A.Sc. (Elect. Engrg.), (Univ. of Toronto), telephone engr., Northern Electric, Montreal, Que.
Zurowski, Raymond Albert, B.Sc. (Elect. Engrg.), (Univ. of Man.), asst. elect. engr., Canada Cement Co., Montreal, Que.

Students at Ecole Polytechnique

Barbeau, Robert Andre, 4890 Hutchison St., Montreal, Que.
Barriere, Jacques, 2366 Blvd. Gouin, West, Cartierville, Que.
Beauchamp, Gaston, 5318 Berri St., Montreal, Que.
Beaudet, P. Jacques, 1438 Galt Ave., Montreal, Que.
Beaudry, Maurice Henry, 308 Circle Road, Bigras Island, Que.
Bergeron, Claude, 2072 Valois St., Montreal, Que.
Bibeau, Jules, Berthierville, Que.
Bisaillon, Raoul Jacques, 849 Hartland Ave., Outremont, Que.
Bussiere, Marcel, 167 de L'Epee Ave., Outremont, Que.
Caron, Joseph Henry Guy, 682 Jarry St., Montreal 10, Que.
Chabot, Jean-Marie, 2429 Grand Trunk St., Montreal, Que.
Charlebois, Jean E., 7544 Henri Julien St., Montreal, Que.
Corneille, Jean, 284, 5th Ave., Verdun, Que.
Cote, Bernard, 6646 deLanaudiere St., Montreal, Que.
Cote, Jean-Marie, 1340 Sherbrooke St., East, Montreal, Que.
Crepeau, Jean Guy, 1430 St. Denis St., Montreal, Que.
Daignault, Jean Jacques Marcel, 4550 Christophe Colomb St., Montreal, Que.
Darveau, Georges Emile, 1 St. Charles St., St. Hyacinthe, Que.
Desrochers, Fernand Charles, 2078 Baldwin St., Montreal, Que.
Desrochers, Marcel, 2064 St. Germain St., Montreal, Que.
Desy, Gaston, 1327 St. Zotique St., East, Montreal, Que.
Dionne, Jean-Paul, 7781 Drolet St., Montreal, Que.
Dubuc, Roch, 260 Galt Ave., Verdun, Que.
Dumont, Paul, 805 Sherbrooke St., East, Montreal, Que.
Dumouchel, Leo-Georges, 8636 Henri Julien St., Montreal 10, Que.
Fournier, Charles Jean-Marie, 7476 Christophe Colomb St., Montreal, Que.
Francoeur, Roland, 1297 Christophe Colomb St., Montreal, Que.
Garon, Louis-Charles, 3721 St. Hubert St., Montreal, Que.
Gauthier, Georges Albert, 171 St. Catherine St., West, Montreal, Que.
Grothe, Pierre, 3741 Hutchison St., Montreal, Que.
Grou, Marcel, 15 Roy St., Ville St. Laurent, Que.
Kendler, Emil, 205 Dufferin Road, Hampstead, Que.
Lafontaine, Charles, 1292 Beaubien St., East, Montreal, Que.
Lafontaine, Laurent, 83 de Castelneau St., Montreal, Que.
Lajoie, Maurice, 9 Hinton St., Montreal East, Que.
Laliberte, Paul E., 2090 Beaudry St., Montreal, Que.
Lambert, Jean Louis, 920 Sherbrooke St., East, Montreal, Que.
Landry, Claude Clermont, 5755 Cote des Neiges Rd., Montreal Que.
Lapierre, Marcel L., 12335 Dion St., Cartierville, Montreal 9, Que.
Larochelle, Josephat, 1810 Aird Ave., Montreal 4, Que.
LeBourdais, Raymond, 6595 Briand St., Montreal, Que.
Leblanc, Maurice, 8743-A Lajeunesse St., Montreal, Que.
Legros, Jean, 5527-4th Ave., Rosemount, Montreal 36, Que.
L'Esperance, Gaston, 5037 Adam St., Montreal, Que.
Lesperance, Paul-Emile, 7125 Christophe Colomb St., Montreal, Que.
Letourneau, Robert, 3131 Van Horne Ave., Montreal, Que.
Lolli, Vincent, 1247 St. Timothy St., Montreal, Que.
Martino, Antoine, 6243 de Normanville St., Montreal, Que.
Mayrand, J. Marc, 4836 Christophe Colomb St., Montreal, Que.
Morin, Roger, Prevost, Co. Terrebonne, Que.
Nepveu, Jean Claude, 4589 Fabre St., Montreal, Que.
Paquette, Louis J., 359 Sherbrooke St., East, Montreal, Que.
Pelletier, Denys Maurice, 505 Champagneur Ave., Outremont 8, Que.
Pelletier, Joseph Andre, 228 Roy St., Montreal, Que.
Phaneuf, Jean, 10748 Grande Allee, Ahuntsic, Montreal, Que.
Phenix, Gilles Fernand, Henryville, Co. Iberville, Que.
Prenoveau, Jean-Jacques, 2261 Panet St., Montreal, Que.
Rondeau, Jean-Jacques, 1430 St. Denis St., Montreal, Que.
Sabourin, Jean Robert, 6790 Louis Hebert Ave., Montreal 36, Que.
Soucy, Jacques, 6590 Christophe Colomb St., Montreal, Que.
Theberge, Gabriel, 6283-25th Avenue, Rosemount, Montreal, Que.
Thibaudeau, Raymond, 2461 Duvernay St., Montreal, Que.
Trudeau, Regis, 1430 St. Denis St., Montreal, Que.
Turcotte, Gerard, 3736-a St. Hubert St., Montreal, Que.
Vezeau, Jean Claude, 5317 Fabre St., Montreal, Que.

Students at McGill University

Barrett, George Francis William, 2750 Notre Dame Street Lachine, Montreal 32, Que.
Biard, Gordon, 3592 University St., Montreal, Que.
Borts, Robert B., 1565 Van Horne Ave., Outremont, Que.
Chow, Gerald Ewing, 3512 Durocher St., Montreal, Que.
Colas, Emile, 3927 St. Hubert St., Montreal, Que.
Demers, Jean Robert, 2103 Sherbrooke St., East, Montreal, Que.
Gauthier, Leo Paul, 3458 Belmore Ave., Montreal, Que.
Gosselin, Rene, 3546 Durocher St., Apt. 17, Montreal, Que.
Hahn, Jacob, 1145 Lajoie Ave., Apt. 2, Montreal, Que.

Hanchet, Walter Howard David, 3506 University St., Montreal 2, Que.
Kierans, Martin D., 3502 Northcliffe Ave., Montreal, Que.
Knecht, John Edward, 115 Wickstead Ave., Montreal 16, Que.
Kobayashi, George James, 5868 Bannantyne Ave., Verdun, Montreal 19, Que.
Koch, Donald Ernest, 690 Victoria Ave., Westmount, Que.
Korcz, John, 5677 Fifth Ave., Rosemount, Montreal 36, Que.
Lauren, Olli Kalevi, 3608 Oxenden Ave., Montreal, Que.
Leprohon, Bernard Donat, 1831 Desjardins St., Montreal 4, Que.
Locke, Murray Dougall, 4716 Grosvenor Ave., Montreal, Que.
Macorguodale, Ian, 1509 Sherbrooke St., W., Apt. 38, Montreal 25, Que.
Mills, Charles Geoffrey, 114 Abbott Ave., Westmount, Montreal 6, Que.
Richardson, Kent N., 3460 Rosedale Ave., Montreal 28, N.D.G., Que.
Robertson, William Cook, 1441 Drummond St., Montreal, Que.
Robichaud, Fernand, 3500 Durocher St., Apt. 5, Montreal, Que.
Shama, Arthur Joseph, 3512 Durocher St., Montreal, Que.
Tyler, William John Lyle, 32 Brock Ave., North, Montreal West, Que.

Students at Queen's University

Dalziel, John William Scott, 176 Alfred St., Kingston, Ont.
Noonan, Robert, 162 Earl St. Kingston, Ont.
Wilson, John Edward, 170 Barrie St., Kingston, Ont.

Students at Nova Scotia Technical College

Arklie, David Graeme, Pine Hill Residence, Halifax, N.S.
Doody, William Kevin, Pine Hill Residence, Halifax, N.S.
Landry, William Alexander, 25 Main St., Truro, N.S.
Miller, Edgar, 277 Gottingen St., Halifax, N.S.
Moulton, Richard Walter, 1 Tupper Grove, Halifax, N.S.
Taylor, Gordon Osborne, 49 Spring Garden Road, Halifax, N.S.
Weiner, Norman Daniel, 121 Henry St., Halifax, N.S.

Students at University of New Brunswick

Corelli, Charles Rae, 482 Charlotte St., Fredericton, N.B.
Fenwick, Kenneth Harold, 442 George St., Fredericton, N.B.
Gandy, John Morrison, 105 Grey Street, Fredericton, N.B.
Price, Frank Osborne, 135 Aberdeen Street, Fredericton, N.B.
Young, John Kilburn, McAdam, N.B.

Students at University of Alberta

Baines, William Douglas, 10946-81st St., Edmonton, Alta.
Brown, James Allin, 10729-104th St., Edmonton, Alta.
Carswell, Harry Allen, 10936-87th Ave., Edmonton, Alta.
Hollingshead, Robert John, Hillcrest, Alta.
Kasten, Henry Ludwig, 10820-83rd Ave., Edmonton, Alta.
Lobb, Kenneth R., 9750-91st St., Edmonton, Alta.
Low, Donald Richard, University of Alberta, Edmonton, Alta.
Low, Robert Douglas, University of Alberta, Edmonton, Alta.
McBride, Ian Farquharson Boyd, 9823-113th St., Edmonton, Alta.
McCune, Victor Edwin, 11037-88th Ave., Edmonton, Alta.
Nelson, Seth Reed, Box 114, Cardston, Alta.
Rutledge, Stanley Edmonds, 12803-125th St., Edmonton, Alta.
Sanden, Emil James, Hussar, Alta.
Twidale, Frank Tuma, 8638-108th St., Edmonton, Alta.

Students at University of Manitoba

Funk, John Abram, Lucky Lake, Sask.
Halter, John Lionel, 37 Beveridge Block, Winnipeg, Man.
Henne, Lawrence Earl, 845 Dufferin Ave., Winnipeg, Man.
Livingston, Peter Archibald, P.O. Box 86, Morden, Man.
Riley, Thomas McDonald, 497 River Ave., 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

Monaghan, Cecil Zenas, B.Sc. (Elect.), (Univ. of Alberta), elect. engr., Electric Light & Power Dept., City of Edmonton, Alberta.

Junior to Member

D'Appolonia, Elio, B.Sc. (Univ. of Alberta), instructor, civil engineering, University of Alberta, Edmonton, Alta.

NOVA SCOTIA

Members

Benjamin, Frederick Remby, B.Eng. (Mech.), (Nova Scotia Tech. Coll.), genl. engrg., Engineering Service Co., Halifax, N.S.
Gorman, William Edmund, company engr., Standard Paving Maritime Ltd., Halifax, N.S.
Hines, William Sylvias, B.Sc. (Elect. Engrg.), (McGill Univ.), chief investigations engr., Civil Service Commission, Dept. of Fisheries, Halifax, N.S.
Perry, Frederick Lloyd, B.Sc. (Chem. Engrg.), (Queen's Univ.), asst. engr., process control dept., Imperial Oil Ltd., Dartmouth, N.S.
Willis, Sherred Allen, B.Sc., C.E. (Lafayette Coll., Easton, Pa.), mgr., Canadian Gypsum Co., Windsor, N.S.

QUEBEC

Members

Gantz, Alfons, ingenieur constructeur (Univ. of Lausanne, Switzerland), rentals appraiser, Wartime Prices & Trade Board, Montreal, Que.
King, Burton Wensley, B.Sc. (Civil), (Queen's Univ.), executive engr., Canadair Limited, Montreal, Que.
MacArthur, John Alexander, B.Sc. (Engrg.), (Univ. of Glasgow, Scotland), engr., Sherbrooke Machineries Ltd., Sherbrooke, Que.
Skelton, Cecil Hastings, B.Sc. (Mech. Engrg.), (McGill Univ.), mech. engr. (appraisal), Hydro-Quebec, Montreal, Que.

Student

Lorrain, Alexandre Alphonse, B.Sc. (Civil Engrg.), (Univ. of Sask.), dist. engr., Dept. of Colonization, La Sarre, Abitibi, Que.

Junior to Member

Ingram, Wallace W., B.Sc. (Elect. Engrg.), (Univ. of Man.), asst. supt., head, impregnating dept. foreman, Phillips Electrical Works, Montreal, Que.
Mellor, John Harold, B.Sc. (Mech.), (McGill Univ.), chief engr., Canadian Copper Refiners, Montreal, Que.

Student to Junior

Gibson, Ronald Franklin, B.Sc. (Mech.), (Univ. of Sask.), jr. engr., Montreal Engineering Co., Ltd., Montreal, Que.

SASKATCHEWAN

Members

Holland, Arthur A., B.Sc. (Mining), (Queen's Univ.), managing dir., consultg. engr., National Sodium Products of Sask., Moose Jaw, Sask.
Killer, Frederick Anderson (Queen's Univ.), geologist, Imperial Oil Limited, Moose Jaw, Sask.
Wickware, Herbert Fairbairn, B.Sc. (Elect.), (Univ. of Man.), Regina, Sask.

Student

Klassen, Henry William, Lieut., R.C.E.M.E., B.Sc. (Mech.), (Univ. of Sask.), North Battleford, Sask.

Erratum

In the list of Elections and Transfers, on page 669 of the October 1945 *Journal*, Mr. Nicholas Fodor was shown in error as a graduate of the University of Toronto. Mr. Fodor is a graduate of the University of Prague, Czechoslovakia.

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 a basis of personal items in the *Journal*.

J. W. Jolly, M.E.I.C., has vacated the post of inspector of fuses which he has held for the past five years with the Inspection Board of United Kingdom and Canada. He has joined the Timken Roller Bearing Company as general manager of their Canadian plant at St. Thomas, Ont.

A. D. Scott, M.E.I.C., is now assistant engineer with the Jamaica Government Railway, Kingston, Jamaica, B.W.I. For the past four months he has been acting chief engineer while the chief engineer has been on leave. He is a graduate of McGill University in the class of '40.

H. O. Brown, M.E.I.C., is now associated with the Abitibi Power and Paper Company, in the capacity of assistant engineer at the head office engineering department at Toronto, Ont. He was formerly employed with Massey-Harris Limited at Toronto.

James W. Houlden, M.E.I.C., formerly ballistic engineer for the "Dominion" Ammunition Division of Canadian Industries Limited at their Brownsburg, Que., works, has been appointed special assistant to the sales manager at Montreal head office. A graduate of Queen's University in mechanical engineering, Mr. Houlden joined C.I.L. in 1935 as a ballistic technician.

A major in the Royal Montreal Regiment (Reserve), Mr. Houlden's technical knowledge of ammunition is matched by his ability as a rifleman. Winning a place on the Canadian Bisley Team nine times in twelve years, he made the trip overseas in 1926, 1927, 1929 and 1932.

T. R. Durley, M.E.I.C., has been discharged from the R.C.N.V.R. with the rank of lieutenant-commander and has returned to the Manufacturers Mutual Fire Insurance Company of Providence, R.I as field engineer in Montreal. He was granted leave of absence by the company in 1942 on his appointment as superintendent of shell filling at the plant of Stormont Chemicals Limited at Cornwall, Ont. In the following year he joined the electrical branch of the R.C.N.V.R. He served in the Directorate of Engineering, then following a term at sea he became fire prevention officer at headquarters in Ottawa.

A. S. Mansbridge, M.E.I.C., is now with Bloedel, Stewart and Welch, Limited, engineering department of the pulp division, as designer for their new sulphate plant at Port Alberni, B.C. He was previously with the engineering department of West Kootenay Power and Light Company from which he resigned on the completion of their power house and dam at Brilliant, B.C.

James R. B. Milne, M.E.I.C., has joined the staff of the Lake St. John Pulp and Paper Company at Dolbeau, Que. He previously held the position of production superintendent at the Longueuil, Que., plant of the Dominion Engineering Works Limited.

Dr. F. A. Gaby, M.E.I.C.

Dr. F. A. Gaby, M.E.I.C., past-president of the Institute, has retired from active duties as executive vice-president of The British American Oil Company Limited.

Dr. Gaby was born at Richmond Hill, Ont., and graduated from the School of Practical Science, University of Toronto, receiving the degree of B.A.SC. in 1903 and those of M.E. and E.E. in 1904. Following graduation he became associated with several well-known electric power companies, including the Canadian General Electric, Toronto-Niagara Power and Point du Bois (Winnipeg). He was chief assistant engineer of the Hydro-Electric Power Commission of Ontario in 1907 and from 1912 until 1934 he was chief executive officer of the Commission. In 1924 he was honoured by the University of Toronto, receiving the degree of Doctor of Science as a recognition of his outstanding work in the field of hydro-electric power engineering in Canada.

Early in 1934 Dr. Gaby severed his connection with the Hydro-Electric Power Commission of Ontario and became consulting engineer with Noranda Mines Limited. Later in that year he was appointed assistant to the president of the Canadian Pacific Railway Company, with headquarters in Montreal, and at the same time assumed the duties of vice-president and general manager of the Seigniory Club Association of Montebello. In 1936 he became executive vice-president of The British American Oil Company Limited.

Dr. Gaby became a member of the Institute in 1919 and served as president in 1935. His contribution to engineering has been recognized by fellowships in many national and international engineering societies.

Capt. Wm. B. White, M.E.I.C., of the Royal Canadian Engineers, has been posted to Montreal, Que., from Wainwright, Alta., where he served as engineer works officer of the Wainwright Internment Camp.

J. W. S. Chappelle, M.E.I.C., has resigned from the Public Works Department at Edmonton to start his private practice as a civil engineer on engineering construction at Edmonton, Alta.

Group Captain C. A. Davidson, M.E.I.C., has been transferred from No. 2 Air Command Headquarters at Winnipeg, Man., to Maintenance Command at Uplands, Ont. Group Captain Davidson has been made an Officer of the Order of the British Empire.

Jacques Gréber, M.E.I.C., a city planner of international reputation, has been appointed adviser to the City of Montreal Planning Department upon the recommendation of its director, Aimé Cousineau, M.E.I.C.

R. H. Hobner, M.E.I.C., of Defence Industries Limited, has been appointed assistant project engineer on special projects at Montreal, Que. He was formerly superintendent of maintenance with the company at Bouchard Works, Jean Brillant, Que.

J. H. McIntosh, M.E.I.C., has accepted a position with the Associated Portland Cement Manufacturers Limited in England. He served with the Coast Regiment of Royal Canadian Artillery with the rank of major.

Alex. R. Moffat, M.E.I.C., has accepted a position with the Ontario Hydro-Electric Power Commission as assistant engineer on construction at Arnprior, Ont. He was formerly resident engineer for the Naval Service at Renous, N.B.

Norman Bell, M.E.I.C., who is employed by the Aluminum Company of Canada Limited at Arvida, Que., has been granted leave of absence by the company in order to do post-graduate work at the University of Pittsburgh, Penn.

Flight-Lieutenant E. S. Braddell, M.E.I.C., has been released from active service and transferred to the R.C.A.F. reserve of officers. He was in the aeronautical engineering (electrical) branch and served overseas with the Lancaster Squadrons in an R.C.A.F. Bomber Group. He has returned to the Northern Electric Company Limited, power apparatus division, Montreal, Que. Prior to his enlistment he was with this firm at Winnipeg, Man.

L. P. Cousineau, M.E.I.C., has been appointed town engineer at Val d'Or, Que. For the past four years he had been employed with the Dufresne Engineering Company Ltd., Montreal, on construction work. In 1944 he was on loan from the Dufresne Engineering Company to the Quebec Shipyards Limited at Quebec.

H. A. Lancefield, Jr.E.I.C., is at present employed by the Mathews Conveyer Company Limited at Port Hope, Ont. He was recently released from the R.C.A.F. with the rank of flying officer.

G. V. Bourbonnais, Jr.E.I.C., who served overseas with the Royal Canadian Engineers, is now assistant superintendent of the St. Malo shops of the Dominion Arsenal at Quebec, Que.

W. K. Clawson, Jr.E.I.C., has accepted a position with the Horton Steel Works Limited. He is at present employed at the Fort Erie, Ont., plant. He served overseas with the Royal Canadian Engineers and was released with the rank of captain.

Philip Ewart, S.E.I.C., has obtained leave of absence from the Quebec Roads Department and is doing post-graduate work in traffic research at Yale University.

Ira M. Beattie, S.E.I.C., who has been employed by the Canadian Bridge Company at Walkerville, Ont., has recently received the appointment of assistant professor of civil engineering at the University of New Brunswick, Fredericton, N.B.

John D. Abell, S.E.I.C., who recently resigned his position with the Northern Electric Company, Montreal, is now employed by the International Harvester Company, Hamilton, Ont., as a mechanical engineer.

R. R. Smith, S.E.I.C., has been released from the Canadian Army with the rank of lieutenant, and is now employed by H. G. Acres and Company, consulting engineers, at Niagara Falls, Ont.

P. M. Rebin, S.E.I.C., has joined the staff of the Vulcan Iron Works in the engineering department at Winnipeg, Man. He was formerly draughtsman with Waterous Limited, Brantford, Ont.

R. J. Blezard, S.E.I.C., who graduated last spring in mechanical engineering from the University of Saskatchewan, is now employed as junior engineer with Link Belt Limited at Toronto, Ont.

Obituaries

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

Richard Smith Lea, M.E.I.C., died on November 11th, 1945, in Charlottetown, P.E.I., following a lengthy illness. Born at Victoria, P.E.I., on April 11th, 1866, he attended the Prince of Wales College, Charlottetown, and McGill University, Montreal. At the latter he obtained his B.Sc. in 1890 and his Ma.E. in 1893.

After post-graduate work at Cambridge University, England, Mr. Lea lectured in mathematics and was assistant professor of civil engineering at McGill University from 1893 until 1902 when he established a private consulting practice. He remained in that work until 1913 when he became associated with his brother, W. S. Lea, M.E.I.C., Montreal, in general, civil and hydraulic engineering, water supply, drainage, hydroelectric and other power developments, as well as being adviser and arbitrator for companies and municipalities.

Among the many projects that Mr. Lea engineered were the water supply, filtration works and pumping plants for the City of Montreal; earthquake resistant buildings in Kingston, Jamaica; an irrigation dam for the Canadian Pacific Railway on the Bow River, Alta.; the water supply and aqueduct for Greater Winnipeg; the drainage system for Vancouver, Ottawa and Montreal. He had worked on general plans for development of the St. Lawrence river for power and navigation, and on construction engineering work in connection with the Chippawa-Queenston hydro-electric development at Niagara Falls. Since his retirement Mr. Lea had travelled extensively both in Canada and abroad.

Mr. Lea joined the Institute as a Student on January 20th, 1887, the year of its inception, transferring to Associate Member in 1894 and to Member in 1900.

He was awarded the Julian C. Smith medal in 1941 for outstanding service in the development of Canada.

Frederick Allison Bowman, M.E.I.C., one of the pioneers of the telephone industry in Canada, died at his home in Halifax, N.S., on November 14th, 1945. Born in Windsor, N.S., on October 29th, 1863, he was a graduate of King's College, Windsor, in the class of '87 and held the degrees of Master of Arts and Bachelor of Engineering.


F. A. Bowman, M.E.I.C.

Mr. Bowman entered the telephone industry in 1900 and since that time had many responsible executive positions with the Maritime Telegraph and Telephone Co. Limited at Halifax. At the time of his retirement last March he was staff engineer.

Mr. Bowman joined the Institute as a Student on June 23rd, 1887. He transferred to Associate Member in 1891 and to Member in 1905. He was made a Life Member in 1930. Mr. Bowman represented the Halifax Branch on the Council of the Institute during the years 1913-14-15, and again during 1920-21-22. He served as vice-president for the Maritime Zone during 1924-25.

Peter Turner Bone, M.E.I.C., a pioneer of the west, died on October 23rd, 1945, in the General Hospital at Calgary, Alta., after an illness of several months. Born in Ayrshire, Scotland, on April 25th, 1859, he received his engineering training in Glasgow as an apprentice with the firm of Kyle, Dennison and Frew. During his apprenticeship he attended classes at Glasgow University and the Mechanics Institute.

In 1882 Mr. Turner Bone came to Canada and, after working for a year on the O. & Q. Railway, he joined the construction forces of the C.P.R. at Medicine Hat and followed the laying of steel through the mountains to completion. He was the fifth person to take up residence in Calgary and the year 1883-4 was spent in a tent in the heart of the present business section of the city. In 1887 he took part in the construction of the C.P.R. short line through Maine and then returned west to farm for awhile with his Turner cousins in what now bears the name of the family, Turner Valley. He located the C.P.R. lines from Regina to Prince Albert, Calgary to Edmonton and Calgary to MacLeod. In the early 1900's he organized and built the first irrigation scheme in the Calgary district and later became first engineer in charge of the C.P.R.'s irrigation projects east of Calgary to Gleichen. He later returned to Scotland and then, the study of the French language being his hobby, he went to Paris for study at the Sorbonne. In 1903 he settled permanently in Calgary, associating himself closely with civic government and community projects. He was chairman of the town planning commission from its inception until two years ago. For the past several years he had spent his leisure in compiling his memoirs of life in the early West. This book is being published and will be released shortly.

Mr. Turner Bone joined the Institute as a Member in 1914.

William Meldrum, M.E.I.C., councillor of the Institute representing the Lethbridge Branch, died suddenly in Lethbridge, Alta., on November 7th, 1945. Born in Johnstone, Scotland, on July 24th, 1884, he studied mining and surveying at Leeds Technical School, England.


Wm. Meldrum, M.E.I.C.

Mr. Meldrum was apprenticed to an engineering firm at Leeds and in 1909 came to Canada, engaging in general survey work. He enlisted in the Royal Canadian Engineers in 1916 serving until 1920 when he became surveyor at the Galt Mine in Alberta. When the larger mines of the Lethbridge coal field were amalgamated in 1935 he continued in the same capacity for the controlling company, The Lethbridge Collieries Limited.

Mr. Meldrum joined the Institute as an Associate Member in 1925, becoming a Member in 1940. He was one of the oldest and most prominent members of the Lethbridge Branch. He acted as secretary for many years; he served as chairman of the Branch in 1932 and again in 1940. Mr. Meldrum was elected councillor representing the Lethbridge Branch in 1944.

Charles Daniel Sargent, M.E.I.C., died recently at his home in Cornwall, Ont. Born at Barrington, N.S., on November 17th, 1862, he entered government employ through the government railways in 1883, transferring to the Canals Branch of the service in 1891.

During Mr. Sargent's half century of public employment he advanced steadily in position and responsibility until, in 1912, he received his promotion to the engineering superintendency of the Ontario-St. Lawrence Canals and of St. Peter's Canal in Nova Scotia. He held this position for 22 years retiring in December, 1933.

Mr. Sargent joined the Institute as a Student on December 16th, 1887, transferring to Associate Member in 1890 and to Member in 1894. He was made a Life Member in 1934.

Charles Samuel Bennett, M.E.I.C., died suddenly at his home in Halifax, N.S., on November 3rd, 1945. Born at St. John, N.B., on September 5th, 1891, he graduated from the University of New Brunswick with a B.Sc. in civil engineering in 1912. He had been awarded the Ketchum medal for proficiency in the third and fourth years.

Following graduation, Mr. Bennett worked with the Federal Department of Public Works in the Saint John river district, leaving this position to enlist in 1915. With the rank of lieutenant in the 5th Siege Battery, he was on active service in Canada, England and France, returning to his public works post in 1919. In the following year he was associated with the New York Harbour Drydock Company as a construction engineer, returning to similar service with the New Brunswick Commission in 1920. As superintendent and resident engineer with the Fraser Brace Engineering Company from 1925 until 1930 he was closely associated with the construction of power developments in various parts of the Dominion.

Mr. Bennett joined the National Harbours Board in Halifax in 1930 as assistant engineer and in 1937 was named chief engineer of the board at Halifax port. He held this position until his death.

Mr. Bennett joined the Institute as a Junior in 1914, transferring to Associate Member in 1927. He became a Member in 1940. He was active in engineering organizations and had served as chairman of the Halifax Branch in 1936.

Percy Lawrence Wilcox, M.E.I.C., died at his home in Dartmouth, N.S., on June 15th, 1945. Born at Windsor, N.S., in 1881, he graduated from King's College, Windsor, with the degree of Bachelor of Engineering in 1905.

After graduation he became associated with the Great Northern Railway as transitman and resident engineer. During the first World War he served with the rank of lieutenant in the 7th Battalion Canadian National Railway Troops in France and Belgium. For several years he was employed as civil engineer with the Department of Highways of Nova Scotia.

Mr. Wilcox joined the Institute as a Member in 1940

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*

The Calgary Branch was addressed by Mr. A. G. Turnbull, manager of the industrial control section of the Canadian General Electric Company, Toronto, on Monday October 15th in the Palliser Hotel. The subject of the address was **New Developments in Industrial Control Equipment.**

The speaker told how the development of the current limiting power fuse for a 2300-volt circuit made possible the more general use of the high voltage magnetic motor starters and the substitution of air break for oil immersed switches. Since the current limiting fuse definitely restricts the amount of short circuit current flow, a control switch with lower rupturing capacity can be used. The current limiting fuse can be incorporated in the indoor cubicle with the high voltage starter. The name "Limitamp" was given to such a combination.

Magnetic switches, combination magnetic switches, relays, etc., can now be incorporated into a factory-built cabinet. All electrical devices pertaining to a particular process or plant department can thus be contained in a compact single unit with resulting savings in space and installation expense. The name "Cabnitrol" has been given to such a unit.

The amplidyne generator played a very important part in the operation of tanks and other war equipment. It made possible the accurate control of D.C. driving motors to a degree unobtainable with the conventional contactors. As amplification the order of 10,000 to 1 are obtainable with this device, heavy equipment can be operated from control circuits carrying minute current. This device is already finding ready acceptance in a wide variety of peacetime applications such as mine hoists, steel mill drives, etc.

Many new electronic controls came into use during the war. These are rapidly being made available to industry. Many operations requiring extreme accuracy are now being performed by electronic devices. The positioning of plates in a multi-coloured printing press, the positioning of wrappers on small packages and the control of automatic spot welding are but a few of the applications.

EDMONTON BRANCH

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

The first general meeting of the Edmonton Branch for the 1945-46 season was held in the Macdonald Hotel at 6.30 p.m. on October 22nd. The speaker was Dr. E. H. Boomer, F.C.I.C., F.R.S.C., professor of chemical engineering at the University of Alberta, whose subject was **German Oil Industry in the War.**

Dr. Boomer, who returned recently from a tour of northwestern Germany, was one of Canada's two oil investigators for the Department of Munitions and Supply, and was attached to the Technical Intelligence Corps under General Eisenhower. Dr. Boomer discussed the history of the organization and its objectives, and dealt briefly with the places, plants and persons investigated on his six-week tour of Germany.

The speaker stated that the British were the first to decide to investigate Germany, but when General Eisenhower became Allied Commander, his Intelligence Corps took over the work. They arranged to study German heavy industry, war chemistry, metallurgy and social, political and financial relationships. . . . . Before D-day the U.S. Technical Intelligence at Washington was given power to call outside investigators and to form teams which were to be sent into Germany behind the advancing armies. The personnel consisted of 30 Americans, 28 Britishers and 2 Canadians.

The objectives, the speaker continued, were divided into two groups, firstly those on the "black list" which were of primary military importance and had to be investigated without delay, and secondly those on the "grey list" which comprised those not completed on the black list and those of importance to civilian use. The latter are still being investigated by a much larger organization than worked on the black list.

Dr. Boomer said that the information obtained from the investigation was still restricted. The investigators had found many documents and would need more time to complete their reports. When the reports are available in Ottawa the information will be given to the appropriate industries.

In the meantime we have Dr. Boomer's general impressions of places he visited and people he met in Germany. The team, of which the speaker was a member, was assigned twelve targets known to the Intelligence Corps from the Hanover-Brunswick line north to Denmark. Besides visiting these targets the team was to find new locations of removed or bombed plants. Many plants were found underground. A total of 30 targets were finally investigated. The investigators were not permitted to visit targets in the Russian Zone of occupation, but were fortunate to find prominent refugees who brought car loads of documents to the Allied zone. In general the speaker considered the German technical personnel was very co-operative in answering questions, but that the executives were obstinate.

German research did not reach the expectations of the investigators. The main German effort was to produce necessary substitute materials regardless of cost. The reactions were fine technical achievements but useless to an economic country. Our industrial plants are constantly improving production by research in the plant but in Germany a change in a plant is directed from a laboratory.

One of the few valuable research results found, according to Dr. Boomer, was that synthetic lubricants are superior to natural lubricants. He also spoke favourably of a synthetic oil refinery working from paraffin wax, a process not successful in this country, but having the advantage that it can operate on a small scale, very unlike the petroleum industry. Much information which is useful to the military is withheld from the public.

The branch chairman, F. R. Burfield, introduced Dr. Boomer, and after an enthusiastic discussion period extended a hearty vote of thanks proposed by T. W. Dalkin.

In the business portion of the meeting a Committee of C. W. Carry and R. M. Hardy was formed to investigate the practicability of compiling data on the behaviour of foundations in the city of Edmonton, and on the types of soil encountered in excavations.

Attendance at dinner was fifty.

LETHBRIDGE BRANCH

T. O. Neumann, m.e.i.c. - *Secretary-Treasurer*
A. G. Donaldson, m.e.i.c. - *Branch News Editor*

On Friday evening, October 26th, members and affiliates of the Lethbridge Branch, together with their wives, enjoyed the first monthly dinner meeting of the season at the Marquis Hotel. About fifty sat down to dinner. Chairman P. E. Kirkpatrick was in charge, and Mr. Clendening introduced the speaker, Mr. H. W. Main of the U.S. Army Transport.

Mr. Main had occupied the position of safety inspector with Betchel, Price and Callahan, during construction of the Alaska Highway and later had joined the Army Transport Command in Alaska which was engaged in shipping supplies from Prince Rupert and ports north to Alaska, the Aleutians and the West Pacific.

He stated that the U.S. had spent 25 million dollars in Prince Rupert in docks and warehouses, and that the port, the largest north of Seattle and having accommodation for six Liberty ships, was deep enough to harbour the trans-Pacific liners. He also described Port Edwards, the U.S. Army base and arsenal, Whittier and Anchorage.

The scenery of Alaska he found disappointing, except in the 50 square miles about Mount McKinley where there is an expensive tourist lodge.

The resources of Alaska are mainly fur, fishing and minerals. The United States paid Russia 7 million dollars for Alaska, but in ten years, the produce of Alaska amounted to 35 millions. New types of machinery developed during the war will enable many of the Alaska mines to process their dumps. The Juneau Mine with 62 miles of tunnel was one of these.

In describing briefly the Alaska Highway, the speaker mentioned the difficulties encountered in construction through volcanic ash, glacial silt, and muskeg areas. He stated that the chief engineer of the U.S.E.D. believed annual maintenance of the highway would cost at least 5 million dollars.

Mr. Main mentioned the famous Matanuska Valley with a climate like that of southern Alberta and which produced good crops and large herds of cattle.

He pointed out that the herds of caribou, moose, elk and deer in the Yukon had always been prey for wolves. Before the war, the Indians kept the wolves in check by shooting them for the bounty and selling the skins. When the construction crews moved in to build the highway, the Indians made large amounts selling tourist curios to the workers and ceased shooting. As a result the elk and deer have been nearly exterminated by the wolves.

Mr. Main had attended public and high school in Lethbridge in the early days and said he knew many of the old timers who had gone to school here.

After an intermission the speaker exhibited a number of excellent and interesting films of the wild life and scenery in the Yukon, Alaska and in the Eastern Arctic. Two of the longer films were "Alaskan Adventure" and "Arctic Thrills". The former showed nearly every type of game in Alaska, while the latter showed excellent views of seals, walrus, and polar bears. The projector was loaned and operated by the International Harvester Company.

A. L. H. Somerville thanked the speaker.

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. - - }

On Thursday evening November 1st, Dr. Wallace Clark, consulting management engineer and head of the company bearing his name gave a brief talk to the members of the Montreal Branch. The subject of his address was **What is Good Management.**

Dr. Clark explained that the duties of the technical engineer were to carry on research, develop products, processes, machines and equipment whereas it is the duty of the management engineer to apply methods for economically using the knowledge and information of the technical engineer.

The speaker then showed how the problems of management varies from industry to industry and from shop to shop in the same industry. He especially pointed out the differences between the agricultural industry which employs many men with few machines and the metal goods manufacturing industry which employs relatively few highly skilled men and great capital outlay in machinery, tools, etc.

In answer to a question, the speaker explained that in many industries little can be gained by time and motion studies, but great savings can be had by revising existing management and control systems.

G. Lorne Wiggs was chairman of the meeting at which the attendance was so large that many were turned away through lack of accommodation.

NIAGARA PENINSULA BRANCH

J. A. Pasquet, Jr.E.I.C. - *Secretary-Treasurer*
J. L. McDougall, M.E.I.C. - *Branch News Editor*

The Niagara Peninsula Branch held its October meeting at Niagara Falls, Ont., on October 25th. Some fifty members and guests attended.

Mr. McMurtry introduced the speaker of the evening, H. J. A. Chambers, who brought the best wishes of the Hamilton Branch of which he is a member.

Mr. Chambers chose as the subject of his address **Steel in the Construction Industry.** He commenced by briefly outlining the methods of manufacture of iron and steel. He pointed out that structural steel, usually a plain low carbon steel, is to-day often substituted by silicon or possibly nickel steels on account of higher strength qualities. The latter may be used to advantage, for example, in long spans, where the ratio of dead to live load is great, i.e. where " payload " is the important factor.

In considerable detail and with the aid of lantern slides the speaker outlined the mechanics of operation of a typical structural steel fabricating company, made up in part of departments as the following: contracting, engineering and draughting, shop or fabricating, erection, as well as auxiliary departments such as purchasing, plant maintenance, and accounting. The selection of slides included some interesting examples showing the adaptability of the present day structural steel shop with the advent of welding supplanting many of the once familiar heavy iron and steel castings.

Expressing the appreciation of all members present, A. Herr thanked the speaker for his interesting paper and for so aptly answering the many questions in the discussion which followed.

SAGUENAY BRANCH

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

On Thursday October 25th, Mr. F. L. Lawton, assistant chief engineer of the Aluminum Company of Canada, Limited, Montreal, and Mr. M. G. Saunders, plant engineer of the Aluminum Company of Canada, Limited, Kingston, presented to the Saguenay Branch a joint paper entitled **Modern Electric Boiler Installation at Arvida.**

Mr. Saunders traced the development of steam generation at the Arvida Works of the Aluminum Company of Canada, Limited, up to the present time. It is now the second largest steam plant in Canada, being exceeded only by that of the Polymer Corporation at Sarnia. At the present time it includes three combustion boilers rated at 30,000 lb. per hour each, six combustion boilers rated at 131,000 lb. per hour, and five electric steam generators, one rated 8,000 kilowatts, two at 15,000 kilowatts and the two latest at 37,500 kilowatts each.

At one stage of the development the steam demand called for a large volume of steam for about ten minutes, once in every four hours. To provide for this surge, an attachment was added to one of the electric steam generators. This consisted of an auxiliary tank containing water which was maintained at boiler temperature. This water could be forced into the boiler when a sudden demand was made, and returned to the auxiliary tank when the demand was past.

The latest addition to the steam plant consists of two electric steam generators rated at 37,500 kw. each, and housed in a specially constructed building. This installation involves several features which are believed to be unique in electric boiler installations. The building contains a basement and the lower head of the boiler extends through the floor into the basement. Thus the blow-off tank and the piping is installed in the basement, where it can easily be serviced. A hatch is provided in the floor so that all the electrodes can be serviced in the basement.

The floors are tile covered to reduce the dust and to improve appearances.

The controls for the boilers are centralized at a control desk in a separate room, which is separated from the boiler room by a heavy plate glass window.

Each boiler is of the three-phase type in a single tank operating at 6600 volts. The tank is 96 in. in diameter, all-welded construction designed for 250 lb. per square inch. This is the first time that all-welded construction has been used, and it has proved highly satisfactory.

By means of a special charging device the resistance of the water is maintained at about 600 ohms per cubic inch. This provides a current density of about 0.96 amps. per square inch of electrode, since it has been found that densities in excess of one amp. per square inch tend to result in segregation of the water.

The pitting on the boiler head has apparently been stopped by means of a grid placed over the head and attached directly to the ground connection. Tangential dryers are placed in the headers resulting in steam of about 98.5 per cent quality at boiler rating. The heat from condensate and the bleed is almost entirely recovered in feed water treatment.

Mr. Lawton described in some detail the type of insulation used for the boiler. From the point of view of permanence, insulation value and resistance to possible leaks, the insulation selected was aluminum foil air cell insulation. This insulation was made by using layers of aluminum foil of four ten-thousands inch thickness. A special die was made to give the foil a ¾ in. corrugation. Ten layers of this corrugated foil were placed, one on top of the other with the corrugations at right angles, providing a total thickness of 4 in. with air spaces of from ½ to ¼ in. The bat was then made self-supporting by the application of chicken netting to each side. This was then mounted inside the steelgrid on the boiler, and the whole encased in aluminum alloy sheath which was attached to the steel grid by means of self-tapping screws.

Following considerable discussion a vote of thanks to the speakers was moved by J. W. Ward.

SARNIA BRANCH

F. Frank Dyer, M.E.I.C. - *Secretary-Treasurer*
C. E. Leon, S.E.I.C. - - *Branch News Editor*

On Saturday November 17th, the newly-formed Sarnia Branch held its second meeting, a dinner meeting, at the Sarnia Golf Club. Chairman G. L. Macpherson presided; the attendance was fifty.

A short business discussion was held immediately after the dinner. Frank Dyer mentioned the exhibit of " Mulberry " Harbour that will be in Windsor shortly and suggested that the Sarnia Branch organize a trip to Windsor to view this very interesting model.

Mr. Ralph Wicket, Director of Guidance for the Sarnia Board of Education, spoke a few words asking for the future help of the Branch in advising students who were interested in the profession of engineering as a future career.

The speaker of the evening was Mr. J. T. Thwaites, electronics engineer with Canadian Westinghouse Co. of Hamilton. Mr. Thwaites' subject was **Now It Can be Told.** Immediately after his graduation from Queen's University, Mr. Thwaites spent several years with the Westinghouse Company as radio development engineer. Subsequently he was research engineer in Westinghouse, and just prior to the war did research work on the electrolitic refining of aluminum ore. During the war he helped develop anti-radar technique while working with the U.S. Signal Corps. For his work with the U.S. Government he received a citation "In appreciation of effective service". During the latter part of the war, he continued his anti-radar work with scientists in England.

Mr. Thwaites opened his remarks by stressing the guidance from some Greater Power that puts results before our research scientists. Without this intangible help, many of the scientific achievements that turned the tide of the war would not have been found so soon.

In connection with his work with the aluminum industry of Canada, he applauded the complete co-operation received in the development and construction of Arvida plant. In October 1939 the British government issued a plea for more aluminum. Delivery date for Arvida's rectifiers had been set at April 15, 1941. Actually, the rectifiers were delivered the early part of August 1940. On August 17th, the first pour of 60,000 lb. of aluminum was made. On September 15th, the Battle of Britain began, and on this date some Arvida aluminum was flying in this epic battle. Canadian aluminum was one of the turning factors of the war. In an effort to speed production of aluminum, wiring of the five million dollar rectifiers was not checked. It has not been checked yet. "Some Greater Power" had guided their efforts to make all work correct. This was typical of all the Arvida installation.

Referring to radar, he pointed out that the basic principle of radar was formulated in Britain as early as 1922. By 1937 Britain had complete radar installations on the south-east coast of England. To confuse German secret service agents, the purpose of this equipment was disclosed as beam antennae for broadcasting to India. At the Battle of Britain, this radar installation was ready for the Germans and provided another turning point in the Battle of Britain.

In America, radar was in the experimental stage in 1939. The first American radar installation was at Pearl Harbour, December 1st, 1941. This set was built and installed from British plans. During the following years of the war, American production technique was responsible for the mass-production of radar sets. Where it took 40 hours for a unit to be completed by British manufacturers, American production planning accomplished the manufacture of a similar unit in only one hour.

The basic principle of radar can be compared to the phenomena of human sight. If light waves happen to be the same wave-length as fog or dust particles, we cannot see through the fog. In radar, a wave-length of 100 times the length of light waves is used, thus penetrating even the thickest fog. A transmitter is employed, which is comparable to a searchlight in the analogy with light. Radar waves are reflected from the object and "seen" by a receiving set and recorded on a screen. This receiving set may be compared to the human eye and brain.

Radar has been credited with many accomplishments. It was due to radar that the German battleship *Schornhaorst* was detected and sunk. In connection with this incident, the British admiral was observing the radar image of the German ship after the battle had begun, when suddenly the image disappeared. First reactions were that the radar was out of commission. However, upon sailing to the location of the *Schornhaorst* all that could be seen were bits of wreckage. The *Schornhaorst* had been sunk!

At nineteen miles range, radar gun-laying installations will give an accuracy of twenty yards in range and a fraction of a minute in angle. In the Coral Sea, two Jap ships were spotted by radar. Guns were laid by radar and fuses set by radar range and the first salvo hit the Jap magazines.

Among peacetime uses of radar will be guiding ships into harbours during poor weather, landing planes on fog-bound airports. As an example of installations on aeroplanes, Mr. Thwaites pointed out that in a radar-equipped plane flying over New York City, the installation will provide a map for the pilot in such detail that he can pick out the city streets.

In referring briefly to atomic research, Mr. Thwaites mentioned that pioneer work had been done in Canada as early as 1937. The greater part of the following research was done at Queen's University, Kingston, and Cambridge University, England. One of the difficulties encountered in the segregation of U-235 was, that in ordinary water there are enough heavy hydrogen molecules to set it off. In early work, part of the segregation procedure involved boiling of the uranium ore, thus retarding the discovery of U-235.

In dealing with anti-radar, Mr. Thwaites pointed out that the purpose of the Dieppe raid was to capture intact a complete German radar set, with the purpose of discovering a method of blocking German radar installations. The effect in the invasion of the successful radar blocking was comparable to 20 divisions of troops landed at once.

In describing anti-radar equipment, Mr. Thwaites explained that the equipment used was a high frequency transmitter with a 'noise source' and a motor-driven variable condenser revolving at 4000 rpm. and sweeping a band of 2 to 6 megacycles. This had the effect of knocking out all radar and also all radio communication. In the invasion, the allies were prepared for the lack of radio communication and used stop-watch timing. However, lack of radio sent the Germans into a state of consternation. All that could be received was a shrill, high-pitched buzz. On German radar screens, all images were completely jumbled.

Shortly after landing, sufficient German code books had been captured that the anti-radar was shut off to allow monitoring of German radio. The anti-radar transmitter was so powerful that it was used in drowning out German command orders and was used to send false orders to various German units.

In connection with the V-bomb blitz, Mr. Thwaites pointed out that in the case of the V-1, there was no scientific method of combating it. V-1's were nothing but projectiles and were not radio-controlled in any way. With respect to the V-2 bombs however, they were ideal from the scientific point of view. They were equipped with the finest radio sets in the world. Anti-radar equipment was used to unbalance the radio control devices of these bombs. In using the anti-radar equipment, after sighting the V-2, it was necessary to catch its frequency, tune the transmitter to the bomb's wave-length, and press the detonating button in the space of thirty seconds.

To overcome this anti-radar destruction of his V-2 bombs, Jerry made the radio control inactive after 50 seconds of flight, i.e.—before in range of British radar. The proximity fuse locked out until after 4 minutes of flight, i.e. until the bomb had practically reached its target. This made anti-radar detonation extremely difficult.

To overcome both the V-1 and later the V-2, Perce Lovell of Bell Laboratories, N.Y., designed a calculating machine for anti-aircraft gun laying. By training the sights on a bomb, all required information was received for the machine in one second. One-quarter second later the gun had been aimed and fired to a point where the bomb would be 25 seconds later.

Referring to hours of work in English Research Laboratories, Mr. Thwaites mentioned that they were from 7.00 a.m. to 10.00 p.m. In concluding his talk, he asked a solemn consideration for the luxuries that we, in Canada, have known during the war, and an appreciation for the hardships that have been endured and still are being endured in England and on the Continent.

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 on Thursday, October 18th at 8 p.m., in theatre F at the University of Manitoba, with J. W. Battershill, a member of the Professional Engineers, presiding.

Two illustrated papers were presented, being those selected for E.I.C. prizes to undergraduates of the University last year: one on electrical engineering and one on civil engineering subjects.

Dean E. P. Fetherstonhaugh introduced the speakers: W. C. Porter, S.E.I.C., **Description of Seismic Exploration in Relation to Ore or Oil Bodies,** and E. M. Scott, S.E.I.C., **Operation and Construction of the Modern Oil Circuit Breaker.**

Mr. Porter gave an interesting outline of the principles of seismic exploration, explaining fully pictures shown of the actual equipment and graphs of records taken.

Mr. Scott gave a very complete description of the oil circuit breaker, explaining the theory involved. A number of interesting slides were shown, illustrating the main features of the paper.

The speakers were thanked by D. M. Stephens, who conveyed the congratulations of the meeting on the manner in which the student engineers presented their papers.

The meeting then adjourned to the cafeteria, where members met at an informal gathering.

Library Notes

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

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS

Introduction to Magnesium and Its Alloys:
By John Alico. N.Y., Ziff-Davis, 1945. 6½ x 9½ in., 183 pp., illus., $5.00.

National Directory of Commodity Specifications:
U.S. National Bureau of Standards. Wash., Government Printing Office, 1945. 8 x 10½ in., 1311 pp., $4.00. (National Bureau of Standards Miscellaneous Publication M178, replacing M130.)

Public Investment and Capital Formation; a Study of Public and Private Investment Outlay, Canada, 1926-1941:
Dominion-Provincial Conference on Reconstruction. Ottawa King's Printer, 1945. 9¼ x 11½ in., tables, 128 pp.

Symposium on Plastics:
Philadelphia District Meeting, American Society for Testing Materials, Feb. 22-23, 1944. Phila., American Society for Testing Materials, 1944. 6 x 9 in., illus., 200 pp., $1.75.

Tables of Arc Sin X:
Prepared by the Mathematical Tables Project, Conducted under the Sponsorship of the National Bureau of Standards. N.Y., Columbia University Press, 1945. 8¾ x 10¾ in., 121 pp., $3.50.

Tables of Associated Legendre Functions:
Prepared by the Mathematical Tables Project, Conducted under the Sponsorship of the National Bureau of Standards. N.Y., Columbia University Press, 1945. 8¾ x 10¾ in., 303 pp., $5.00.

Teacher of Business; the Publishing Philosophy of James H. McGraw:
Edited by G. D. Crain, Jr. Chicago, Advertising Publications, 1944. 6½ x 9¼ in., 91 pp., $1.00.

Theory of Structures:
S. Timoshenko and D. H. Young. N.Y., Lond., McGraw-Hill, Toronto, Embassy, 1945. 6¼ x 8¾ in., 488 pp., illus., $5.00.

Transmission Lines; Design, Construction, and Performance:
Fred C. DeWeese. N.Y., Lond., McGraw-Hill, Toronto, Embassy, 1945. 5¾ x 8½ in., 297 pp., illus., $3.50.

PROCEEDINGS, TRANSACTIONS, REPORTS, ETC.

Argentina. Ministerio de Obras Publicas. Administracion Nacional Del Agua:
Annual Report, 1945.

Canada. Department of Mines and Resources. Bureau of Mines:
Canadian Mineral Industry in 1944.

Canada. Department of Mines and Resources. Bureau of Mines:
Metallurgical works in Canada; Part I, Iron and Steel—Index to Plants.

Canadian Manufacturers' Association:
Report of the Industrial and Scientific Research Conference held at the 74th Annual General Meeting of the Association, 1945.

Engineering College Research Association:
Directory of Member Institutions and their Principal Fields of Research, 1945.

Engineers and Architects Club of Louisville:

Calendar, 1945.

Highway Research Board:

Proceedings of the 24th Annual Meeting, 1944.

Ontario. Department of Mines:

52nd Annual Report, Vol. 52, Part 6, 1943.
53rd Annual Report, Vol. 53, Part 5, 1944.

Royal Institute of International Affairs:

Annual Report of the Council, 1944-45.

Society of Naval Architects and Marine Engineers:

Historical Transactions, 1893-1943.

TECHNICAL BULLETINS, ETC.

Codes of Practice Committee:

British Standard Code of Practice—CP (B) 503, 1945—Code of Functional Requirements of Buildings—Dirt and Vermin.

Electrochemical Society:

Preprint:—*88-7—Study of Nitrogen Fixation at Atmospheric Pressures; The Formation of Cyanogen and Hydrocyanic Acid from their Elements by C. G. Fink and D. M. Wroughton.—88-8—Electrolytic Analysis of Strike Solutions by R. A. Schaefer and J. B. Mohler.—88-9—Anodic Coatings with Crystalline Structure of Aluminum by C. S. Taylor, C. M. Tucker and J. D. Edwards.—88-10—Bright Dipping by Gustaf Soderberg.—88-11—High Temperature Electric Tube Furnace by J. W. Gartland.*

Harvard University. Graduate School of Engineering:

Reprint Series:—*No. 405—Shock waves in Aerodynamics by Howard W. Emmons. (Reprinted from Journal of Aeronautical Sciences, April 1945.)—No. 406—Sedimentation in Water and the Specific Gravity of Cysts of Entamoeba Histolytica by Shih Lu Chang. (Reprinted from American Journal of Hygiene, March 1945.)—No. 407—On the Classification of Observation Data into Distinct Groups by Richard von Mises. (Reprinted from Annals of Mathematical Statistics, March 1945.)—No. 408—Engineers and Engineering in the Massachusetts State Board of Health by Gordon M. Fair. Reprinted from New England Journal of Medicine, April 19, 1945.)—No. 409—On the Non-Linear Vibration Problem of the Elastic String by G. F. Carrier. Reprinted from Quarterly of Applied Mathematics, July 1945.)—No. 410—An Approximate Representation of the Electromagnetic Field in the Vicinity of a Symmetrical Radiator by C. W. Harrison, Jr. Reprinted from Journal of Applied Physics, July 1944.) Mutual and Self-Impedance for Colinear Antennas by Charles W. Harrison, Jr. (Reprinted from Proceedings of the Institute of Radio Engineers, June 1945.) On the Distribution of Current Along Asymmetrical Antennas by C. W. Harrison, Jr. (Reprinted from Journal of Applied Physics, July 1945).*

Ohio State University. Engineering Experiment Station:

Bulletin: *No. 123—Stress Relief of Weldments for Machining Stability: Part 2, by J. R. Stitt.*

Society of Naval Architects and Marine Engineers:

Preprints: *No. 1—Economic Features of Low-Pressure Evaporating and Distilling Plants for Merchant Ships by M. L. Ireland, Jr.—No. 2—Experience with Merchant Ship Propulsion Machinery in War by D. S. Brierley.—No. 3—Cargo Handling and Its Relationship to Overseas Commerce by A. C. Rohn.—No. 4—Adaptations of the Basic Liberty Design by E. B. Williams.—No. 5—Ore Carrier S. S. "Venore" by H. F. Robinson and E. P. Worthen.—No. 6—Marine Gas Turbine Plant by C. R. Soderberg, R. B. Smith and Lt. Cdr. Ashton T. Scott.—No. 7—Large Passenger-Carrying Ships for Certain Essential Trade Routes by James L. Bates.*

Svenska Forskningsinstitutet for Cement Och Betong Vid Kungl Tekniska Hogskolan I Stockholm:

(Swedish Cement and Concrete Research Institute at the Royal Technical University, Stockholm):

Handlingar: *No. 1—Forestandarens Redogorelse For Verksamheten Under Tiden, July 1st, 1942—June 30th, 1944. (Report of the Director of the Organization and Progress of Work).—No. 2—Beskrivning av Cement Och Betonginstitutets Byggnad, May 1945. (Swedish Cement and Concrete Research Institute; Description of the Building.)—No. 3 (e)—Chemical Processes in the Hardening of Portland Cement by Rune Hedin.—No. 4 (e)—On the Modulus of Elasticity of Concrete by Erik Forslind.—No. 5 (e)—Weat Resistance Test on Concrete Floors and Methods of Dust Prevention by George Wastlund and Anders Erikson.*

PAMPHLETS

Adult Education in Britain:

United Kingdom Information Office, Ottawa, March 1945.

Britain and World War II; a Chronology, Vol. 1, Sept. 1939—Dec. 1940:

United Kingdom Information Office, Ottawa, May 1945.

Britain's Social Services Today and Tomorrow:

By Arthur Wauters. (Circulated by United Kingdom Information Office, Ottawa).

British Commanders:

United Kingdom Information Office, Ottawa, 1945.

CBS American School of the Air:

Educational Division, Columbia Broadcasting System, 1945.

Canadian Petroleum Goes G.S.:

By John Ness. (Reprinted from Canadian Geographical Journal, July 1945).

Charter of the United Nations; Statute of the International Court of Justice; Agreement Establishing the Preparatory Commission of the United Nations:

Ottawa, Wartime Information Board, 1945.

Electric Prestressing of Reinforcing Steel:

By Karl P. Billner and R. W. Carlson. Discussion by P. W. Abeles and authors. American Concrete Institute, Proceedings Vol. 39, 1943.

Industrial Chemicals:

Canadian Industries Ltd., 1945.

Industrial Disarmament of Aggressor States; Germany:

National Engineers Committee of Engineers Joint Council, Sept. 1945.

Lightning in Construction Work; a Symposium:

American Society of Civil Engineers, Tennessee Valley Section, 1945.

New Industrial Electronics Training Course Announced by Canadian General Electric Co. Ltd:

Toronto, Canadian General Electric Co. Ltd., Oct. 1945.

Organization of Technical Research in Industry; a Monograph:

N.Y., Industrial Research Institute, 1945.

Plan for the Future of Dartmouth:

Nova Scotia Municipal Bureau and Department of Municipal Affairs.

Reference Manual on Provincial Rehabilitation Measurers:

Rehabilitation Information Committee, Wartime Information Board, Ottawa, 1945.

Saskatchewan and Reconstruction; Address, and the Saskatchewan Government Presentation to the Dominion-Provincial Conference on Reconstruction:

T. C. Douglas. Regina, Bureau of Publications, 1945.

Statistical Methods Applied to Insulator Development and Manufacture:

J. J. Taylor. Mansfield, Ohio Brass Co., 1945. (Reprinted from American Institute of Electrical Engineers, Transactions, 1945).

Steel H-Beams and Steel Sheet Piling Used as Cantilevers in Soil:

Pittsburg, Carnegie-Illinois Steel Corp., 1938.

Technical Meetings in Glasgow and Edinburgh, Sept.-Dec. 1945; A Syllabus for Engineering, Metallurgical and Chemical Societies:

Association of Secretaries of Technical Societies in Glasgow.

Working of S.A.E. and National Emergency Steels:

N.Y., International Nickel Co., Toronto, International Nickel Co. of Canada, 1945. (Based on articles published in American Machinist, Oct. 18, 1939, Oct. 1, 1942, and revised April 1, 1945).

(Continued on page 809)

PRELIMINARY NOTICE

for Applications for Admission and for Transfer

November 23rd, 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 January 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

BAKER—LORNE PEARCE, of Toronto, Ont. Born at Molesworth, Ont., July 8th, 1911. Educ.: B.A.Sc., (Mech.), Univ. of Toronto, 1935; R.P.E., Ontario; with Can. Genl. Electric, as follows: 1935-36, electrical course, (10 mos.), 1936, design engrg., wiring devices, air conditioning equipt., commercial refrigeration, 1940, electrical washing machines; 1940-44, Canadian Army Overseas, R.C.E.M.E., 1944-45, 2nd i/c R.C.E.M.E. Army Tps., 1945, O.C. Ottawa, Workshops Coy.; and at present asst. trade & industrial commissioner, Ontario House, 13 Charles II St., London, S.W.I., Eng.

References: H. G. Thompson, R. L. Franklin, R. W. Angus, E. A. Allcut, R. C. Wiren.

BYRN—JAMES CHARLES, of 1405 Peel St., Montreal, Que. Born at Victoria, B.C., June 2nd, 1901. Educ.: Graduate, R.M.C., 1921; R.P.E., British Columbia; 1921-22, rigger, Ballantyne Pier; 1922, asst. engr., pipeline constrn., Coquitlam, B.C.; 1922-23, asst. engr., Anyox Dam constrn., Dredging Contractors Ltd.; 1923-24, asst. engr., Puget Sound Bridge & Dredging Co., Seattle, Wash.; engr. i/c constrn., on the following: 1924-25, Wishkah River Bridge, Aberdeen, Wash., 1925-26, Ghebalis River Bridge, Aberdeen, Wash., 1926-27, Georgia Hotel, Vancouver, B.C., 1927-28, Columbia River Bridge, Brewster, Wash., 1928-29, Duwamis River dredging and Boeing Airport constrn.; 1929-30, sub-contractor for hydraulic fill, Springfield Dam, Mass.; 1930-39, supt. i/c dredging, St. Lawrence River; 1939-45, Canadian Army, R.C.E., with the rank of Lt.-Col., i/c design & constrn. of bridges over Maas, Rhine and Nedder Rhine; at present, supt. dredging for Marine Industries, Ltd.

References: G. A. Walkem, B. G. Flaherty, A. S. Rutherford, F. S. Jones, J. F. Plow.

CAMERON—DONALD ROY, of Winnipeg, Man. Born at Grandview, Man., Oct. 24th, 1912. Educ.: B.Sc., (Elect. Engrg.), Univ. of Manitoba, 1934; 1934, rodman, road constrn., Clear Lake; 1934-35, power house constrn., Kanuchuan Rapids, (God's Lake); 1934-35, timekeeper, reinforced concrete, bridge constrn., Macaw & MacDonald, contractors; 1936, inspector, reinforcing steel, grain elevator constrn.; 1936-37, demonstrator, civil engrg. labs., Univ. of Manitoba; 1937-38, service dept., Can. General Elect. Co.; with Vulcan Iron Works Ltd., as follows: 1938-39, cost clerk, 1939 to date, asst. estimator.

References: R. H. Robinson, H. C. D. Briercliffe, W. J. D. Cameron, C. P Haltalin, T. E. Storey, G. H. Herriot, A. E. Macdonald.

CARSWELL—DAVID B., of 710 Roslyn Ave., Westmount, Que. Born at Paisley, Scotland, Aug. 3rd, 1884. Educ.: Manchester Tech. Coll., 1909-12; apprenticeship as follows: 1900-05, mech. engr. & dftsman., 1905-08, marine engrg. at sea, 1908-09, drawing office, 1909-13, works mgr., Manchester, Eng.; 1916-19, asst. genl. supt., Detroit Shipbuilding Co.; 1909-21, asst. genl. mgr., McDougall Shipbuilding, Duluth, Minn.; 1921-27, supt., Canadian National Steamships; 1927-29, genl. mgr., Montreal Dry Docks; 1929-33, managing-director, Canadian Vickers; with Dominion Government, as follows: 1933-39, marine supt., 1939-41, director, general shipbuilding, 1941-45, controller, ship repairs & salvage, 1944-45, director general, shipbuilding, and at present, president, Wartime Shipbuilding.

References: C. D. Howe, R. S. Eadie, L. W. Bailey, H. G. Welsford, J. G. Notman, J. B. Stirling, R. E. Chadwick. F. G. Rutley.

CHIPMAN—SAMUEL GERALD, of London, Ont. Born at Ottawa, Ont., Sept. 7th, 1911. Educ.: B. Eng., (Mining), McGill Univ., 1934; R.P.E., Ontario; 1928-33, (summers), mining, surveying and mapping; 1934-41, mine mgr., including supervision of quarrying, shaft sinking, underground mining, diamond drilling, prospecting, mapping, surveying, road, railroad and genl. bldg. constrn., mill & plant operation, Canadian Refractories Ltd.; 1941-45, Lieut., then Major, R.C.E.; and at present sales engr., engaged on preparation estimates & quotations on boilers & misc. structl. steel and plate work, E. L. Leonard & Sons, Ltd., London, Ont.

References: H. A. McKay, H. G. Stead, L. R. Thomson, N. D. Lambert, J. B. Stirling, G. M. Carrie.

COBURN—HAROLD DOUGLAS, of Montreal, Que. Born at Montreal, Que., Sept. 3rd, 1895. Educ.: Mech. Engr., I.C.S.; 1916-18, shop inspectr., St. Lawrence Bridge Co., Lachine, Que.; with Hydraulic Machinery Co., Montreal, as follows: 1919-21, jr. dftsman., 1922-23, sr. dftsman., 1924-27, sales engr., i/c Toronto office, 1928-32, asst. chief dftsman., 1933-37, chief dftsman, 1938 to date, chief engr., Montreal.

References: E. Cowan, H. J. Roast, N. P. Taylor, E. F. Viberg, J. M. Fairbairn.

CORMACK—JOHN WAITT, of 140 Aubrey St., Winnipeg, Man. Born at Winnipeg, Man., Oct. 24th, 1920. Educ.: B.Sc., (Civil Engrg.), Univ. of Manitoba, 1944; with Dept. of Transport, as follows: 1941, (4 mos.), drainage inspectr., 1942, (5 mos.), paving inspectr., 1943, (5 mos.), instru'man.; with Dept. of Public Works, Canada, as follows: 1944-45, jr. engr., 1945 to date, ngr., grade 2.

References: P. E. Doncaster, E. V. Gilbert, W. A. Capelle, G. H. Herriot, N. M. Hall, A. E. Macdonald, E. P. Fetherstonhaugh.

FELLOWS—GEOFFREY MEYSEY, 813 Richmond St., London, Ont. Born at Beccles, Suffolk, Eng., Feb. 28th, 1905. Educ.: honour cert., Crystal Palace School of Engrg., London, Eng., 1921-25; asst. engr. with Pauling Ltd., on constrn. genl. repair shops for Benguella Rly., Portuguese S.W. Africa; 1928-29, chief engr. i/c power house operated for City of Georgetown, B.G., by Montreal Engrg. Co. Ltd.; 1929-31, resident engr., i/c municipal works for Wynne-Robertson & McLean, consultg. engrs., Toronto; 1931-33, asst. engr., Northern Products Ltd., St. John's N'fld.; 1933-37, learning business of aircraft mfg. at Vickers Aviation Ltd., Weybridge, Eng.; 1937-39, inspector in experimental shop, "Halifax" prototype, Handley-Page Ltd., London, Eng.; 1939-41, brought out from England by Fleet Aircraft Ltd., on "Hampden" constrn., as asst. chief inspectr.; 1941-45, with Central Aircraft Mfg. Co., Ltd., as follows: approved by Dept. of National Defence to accept full responsibility on behalf of 70 inspectors for condition of aircraft leaving plant, and at present chief inspector.

References: R. S. Charles, W. M. Veitch, T. L. Hughson, E. V. Buchanan, D. C. Macpherson.

GRANT—JAMES ANDREW, of Cartierville, Que. Born at Wexford, Ont., Jan. 12th, 1916. Educ.: B.A.Sc., (Mining), Univ. of Toronto, 1942; R.P.E., Ontario; 1939-41, (summers), mining and mill work at Empire Gold Mines, Ltd. and Magnet Consolidated Gold Mines Ltd., surveying at General Engrg. Co.'s. munitions plant at Scarboro, Ont.; 1942-43, time study engr., John Inglis Co., Ltd., Toronto, Ont.; 1943, (5 mos.), methods engr., Victory Aircraft Ltd., Malton, Ont.; 1943, joined R.C.A.F., and at present assigned to Aeronautical Inspection Dept., as inspector stationed at Noorduyn Aviation Ltd., Montreal.

References: C. G. Williams, H. E. T. Haultain, C. R. Young, W. S. Wilson, R. Lord, E. A. Smith.

HEATLEY—JOHN PRATT, of 240 Kathleen Ave., Sarnia, Ont. Born at Edmonton, Alta., March 10th, 1915. Educ.: B.A.Sc., (Chem. Engrg.),), Univ of Toronto, 1938; 1937, (summer), electrolic processing, (2 mos.), smelter building, (3 mos.); 1938, (summer), process work and plant mtce., Leland Canning Co., Simcoe, Ont.; 1938-41, shift operator on various units, testing and treating kerosene and gasoline, and for the last six months, operating foreman, i/c of, Edleanu SO_2 treating plant and lead sulphite and doctor-treating plant, Bahrein Petroleum, Persian Gulf; 1941 to date, Imperial Oil Limited, in production dept., as contact man on utilities—steam, gas, air, water, electricity, etc., also engaged in combustion and efficiency tests in Sarnia boiler houses and process units.

References: G. L. Macpherson, P. Warkentin, F. F. Dyer, J. W. MacDonald, G. W. Christie.

HENDERSON—GORDON ROBERTS, of 108 Cecil St., Sarnia, Ont. Born at London, Ont., March 6th, 1900. Educ.: B.Sc., (Civil), Queen's Univ., 1925; R.P.E., Ontario; 1925-27, (student apprentice course), Ontario H.E.P.C.; 1927-28, hydraulic machine design, Dominion Engrg. Works, Montreal; 1928-32, i/c of installn. of 25,000 kw. hydraulic turbine generator and change of switch structure from 66,000 to 110,000 volts—hydraulic development in northern B.C., survey constrn. of Falls River Power Development, constrn. transmission line crossing the Skeena River; 1932-40, engr. on refining constrn., process operation, refinery equipt. inspector, i/c power plant operation, from January 1936, chief engr. of refinery, Shell Oil Co. of Canada, Ltd., Montreal; 1940-42, i/c constrn. of $18,000,000. refinery, and chief engr. during first year of operation—butane dehydrogenation, Shell Marketing & Refining Co., Heysham, Lancs., Eng.; 1942 to date, chief engr., Polymer Corporation, Ltd., Sarnia, Ont.

References: R. L. Hearn, F. S. Lazier, G. L. Macpherson, T. N. Carter, H. S. VanPatter, J. S. H. Wurtele, E. W. Dill.

HUGHSTON—JAMES FRANKLIN, of 31 Lankin Blvd., Toronto 6, Ont. Born at Shelburne, Ont., Aug. 9th, 1906. Educ.: McGill Univ., 1922-26; 1926-27, piping, layouts, sulphite plant, with Fraser Brace Construction Co., Gatineau, Que.; 1927-28, asst. engr., inspecn., pile driving, reinforced concrete, Harbour Commission of Mtl.; 1928-29, dfting. office, steel detail, Dominion Bridge Co., Lachine, Que.; 1929-31, i/c steel designing for the refinery, estimating for general constrn. work Imperial Oil Refineries, Montreal East; 1931-32, asst. supt. on constrn. of refinery, British American Oil Refineries Ltd., Montreal East; 1932-34, Canadian rep., Nu-Di Products Co., Cleveland, Ohio; 1934-42, own business, Hughston & Rennie, Toronto, manufacturing and distributing dyes, polishes, chemicals; 1942 to date, R.C.E., overseas, with rank of Q.M.S. (Applying for admission as affiliate.)

References: A. I. Bereskin, G. A. McClintock, F. Peden, A. Peden, R. C. Simon, F. Mechin, F. Milligan.

JEFFREY—ALEXANDER, of 192 Kirby St., Sarnia, Ont. Born at Tsaritsyn, Russia, Jan. 30th, 1918. Educ.: B.Sc. (Mech.Eng.), Queen's Univ., 1943; 1943-45, with St. Clair Processing Corporation, as engrg. dftsman., and at present, jr. engr.

References: E. W. Dill, E. K. Lewis, R. W. Dunlop, F. F. Dyer, A. H. Munroe.

JOHNSTON—ALAN H., of Arvida, Que. Born at Grafton, Ont., July 1st, 1911. Educ.: B.Sc. (Chem.Eng.), Queen's Univ., 1934; 1934-35, instructor in chemical engrg., Queen's Univ.; 1935-36, research chemist, Abitibi Power & Paper Co.; 1936-38, lecturer in chem. engrg. plant design, Univ. of Alberta, Edmonton; 1938-42, sectional engr. on constrn. and mtce. in cellulose acetate manufacturing section of plant; 1942 to date, Aluminum Co. of Canada, Montreal, as follows: supervisor in ore plant No. 1, supervisor in pilot plant, and at present project designer.

References: R. S. L. Wilson, T. A. Carter, B. E. Bauman, C. Miller, G. M. Mason.

KEMPNICH—JEAN, of St. Johns, Que. Born at Remilly, Moselle, France, Aug. 30th, 1902. Educ.: Engr., Ecole Supérieure des Travaux Publics, Paris, France, 1924; 1926-27, asst. engr., Chemin de Fer de l'Est; 1927-29, asst. engr., Acieries de Micheville; 1930-35, engr., Pellerin, Ballot & Duval; 1935-38, engr., Acieries de Hagondauge; with Sorel Industries, as follows: 1940-42, supt. of planning, 1942-43, production engr.; 1943 to date, chief engr., Franco Canadian Dyers; St. Johns Textile Mills; Demetre, Sault & Ciriez of Canada.

References: J. A. Lalonde, H. Gaudefroy, E. Gougeon, L. Trudel, A. Fleischmann, Y. Marchand.

KLAWE—CZESLAW H., of 29 Classic Ave., Toronto. Born at Piotrkow Tryb., Poland, March 30th, 1908. Educ.: Elect. Engr., Univ. of Grenoble, 1931; R.P.E., Ontario; 1932, elect. engr., Thermo-Electric Power Plant, Piotrkow, Poland; with Inz. Lesniewski, Poland, as follows: 1932-34, engr., Warsaw, 1934-37, vice-president, 1937-39, mgr. of branch and vice-pres., Katawice; 1940, engr. and asst. tech. mgr., La Précision Mecanique, Paris, France; 1941-43, engr., designer of instruments, Research Enterprises Ltd., Leaside, Ont.; 1943 to date, chief inspector, Prenco Progress & Engineering Corp., Ltd., Toronto, Ont.

References: C. R. Young, W. Czerwinski, J. Korwin-Gosiewski, G. A. Mokrzycki, J. Pawlikowski.

MORISON—GORDON CAMERON, of 3500 Grey Ave., Montreal, Que. Born at Montreal, Sept. 15th, 1899. Educ.: private studies; 1917-21, cost plant accounting, Steel Co. of Canada; 1921-23, sales and cost accounting, Fairbanks-Morse Co.; with Anglo Canadian Wire Rope Co., as follows: 1930-36, supvr. of mfg., 1936-38, field supvr., 1938-45, tech. adviser on field instalns., and at present sales mgr. and sec.-treas., Montreal. (Applying for admission as Affiliate.)

References: D. B. Armstrong, R. Ford, J. M. Richardson, T. Moran, W. S. Taylor, J. B. Macphail, C. Phipps, J. F. Benjafield.

OHRNER—WILLIAM ERNEST, of Gull Lake, Sask. Born at Cantuar, Sask., June 23rd, 1921. Educ.: B.Sc. (Elect.Engrg.), Univ. of Sask., 1943; 1942, (7 mos.), Canadian Westinghouse Co.; 1943 to date in R.C.N.V.R., as follows: 1942 (7 mos.), mech. design, 1943-45, design and installn. of degaussing equipt. and supervision of elect. installns. of minesweeping and degaussing equipt., and at present Elect. Anti-Mining, Base Mtce. Officer, H.M.C. Dockyard, Esquimalt, B.C.

References: E. P. Fetherstonhaugh, A. E. Macdonald, N. M. Hall, R. A. Spencer, W. E. Lovell, A. D. M. Curry.

PIPER—RICHARD LLOYD, of 146 Cecil St., Sarnia, Ont. Born at London, Ont., Dec. 25th, 1901. Educ.: B.Eng., McGill Univ., 1932; 1924 (summer), assayer and asst. to engr., Goudreau Gold Mines, Goudreau, Ont.; 1925 (summer), blast furnace helper, Int. Nickel Co., Ltd., Port Colborne, Ont.; 1925-28, mtce. foreman, pulpwood mill chemist and sulphite mill asst. chemist, E. B. Eddy Co., Ltd., Hull, Que.; 1935 (summer), instru'man., Alidade work, some transit, Geological Survey of Canada; 1935-39, operator on gold kettles, supvr. on same work, chemist on routing analysis, Consolidated Mining & Smelting Co., Trail, B.C.; 1939-42, with British Air Ministry, Washington, D.C., as follows: 6 mos. course in England, 6 mos. course, National Steel Car, at Malton, inspecn. of aircfrat, 22 mos., Aluminum Co. of Canada, Kingston, Ont., inspectr. i/c, responsible for quality of material shipped to England, Australia, South Africa and Canada, 7 mos., Pittsburgh office, on steel inspectn.; 1942 to date, office engr., cracking coil inspectn., genl. engrg. dept. and dfting room, Imperial Oil Limited, Sarnia, Ont.

References: R. Neave, C. P. Warkentin, J. W. MacDonald, M. L. Walker, H. W. Lea, J. E. Armstrong.

PUBLICOVER—LLOYD DAVID, of 418 Claremont Ave., Westmount, Que. Born at Edmonton, Alta., Dec. 19th, 1915. Educ.: B.Sc. (Chem.Eng.), Univ. of Alberta, 1938; R.P.E., Alberta; 1932-37, (summers), erection and mtce. of ammonia refrigeration plants, and operation of diesel engines, McInnes Products Corp., Ltd.; 1938-40, field engr., complete charge of operations of production tests of Turner Valley oil wells, Petroleum & Natural Gas Conservation Bd., Prov. of Alberta; 1940 (7 mos.), asst. to genl. supt., Ventures Limited; 1940-45, joined R.C.E., 2/Lt., and subsequently, Major, demobilized Oct. 15th, 1945; at present tech. engr., Canadian Stebbins Engrg. & Mfg. Co., Ltd., Montreal.

References: R. Gibb, J. Hall, J. R. Groundwater, H. M. Esdaile, C. K. McLeod.

RAYMOND—ANTONIO, of 46 Church St., Ville St. Laurent, Que. Born at Montreal, May 10th, 1910. Educ.: B.Eng., McGill Univ., 1934; with Dominion Rubber Co., Montreal, as follows: 1934-35, time study and development engr.; 1935-37, foreman, rubber lining and special products sales contact; 1937-41, sales representative, Lastex yarn for weaving and knitting industries; 1941-42, mech. engr., Papineau plant water intake, setting up equipt. for production of civilian gas masks, plant installn. for rubber tank tracks; 1942-45, plant supt., Dominion Rubber Munitions, Cap de la Madeleine, Que., .5 inch and 20 m/m small arms ammunition, and at present industrial engr., head office.

References: R. Ford, C. R. Timm, O. K. Ross, P. B. French, O. R. Brumell.

ROBERTSON—ERNEST EDWIN, of 241 Hyman St., London, Ont. Born at Milton, Ont., April 26th, 1916. Educ.: B.A.Sc., Univ. of Toronto, 1939; 1937-38 (summers), aircraft mechanic, etc.; 1939-40, fitter, officer mgr., Canadian Asso. Aircraft, Rochester, Eng.; 1940-41, asst. to plant supt., Canadian Asso. Aircraft, St. Hubert Airport, Montreal; 1941-45, with R.C.N. ,as follows: Flight Deck Engr., Asst. to Engr. Supt., Air Engr., and Director Air Personnel; and at present graduate student, Univ. of Western Ontario.

References: C. R. Young, T. R. Loudon, G. Stephens, A. C. Davy, A. M. Swan, E. R. Jarmain.

SLOAN—JOHN LUXTON, S/L., R.A.F., of Calgary, Alta. Born at Liverpool, Eng., May 26th, 1917. Educ.: Liverpool Tech. Coll., 1930-32, (part time); Louborough Aero. Coll. (Liverpool Univ.), 1932-35; Associate, R. Aero. Society, 1940 (by exam.); 1935-36, jr. metall. chemist, Bristol Aeroplane Co.; 1936-40, with Rootes Securities Ltd., first aircraft inspector, later supt. salvage dept.; 1940, granted commission in R.A.F., 1941-43, posted to Canada as Officer I/C Mtce., 1943-44, returned to England, 1944-45, given command of project for complete overhaul of crashed Lancasters, 1945, posted to British Air Commission Staff, Washington, D.C., attended all British-American conferences on power unit equipt. as British rep., acted as Technical Liaison Officer on all Lend-Lease engines and equipt., and at present awaiting demobilization.

References: J. Haddin, E. W. Bowness, F. A. Brownie, J. B. de Hart, R. C. McPherson.

SMITH—IAN, Lieut., R.C.E., of Calgary, Alta. Born at Coleman, Alta. May 13th, 1921. Educ.: B.A.Sc. (Civil), Univ. of Alberta, 1943; 1941 (summer), surveyor's asst., McGillivray Coal & Coke Co., Coleman, Alta.; 1942 (summer), instru'man., Dept. of Transport, Ft. St. John, B.C.; 1943 to date with R.C.E.

References: R. F. Morrison, R. M. Hardy, L. A. Thorssen, H. P. Keith.

STEPHENSON—ROBERT JOHN, of Edmonton, Alta. Born at Deer River, Minn., Feb. 2nd, 1909. Educ.: 1938-42, Univ. of Sask.—completed 2nd year; 1938-39 (summers), rodman, instru'man., Dept. of Highways, Sask.; with Dominion Government, Dept. of Transport, as follows: 1940, instru'man. and jr. engr., genl. field constrn., charge field drainage, water supply, constrn., 1941, jr. engr., later acting res. engr., same type of work, Regina, 1942, res. engr., same work, Winnipeg, 1943, res. engr., doing same work at Moose Jaw, Davidson, Assiniboia, Mossbank, etc., design of water works and sewerage systems, water supply and drainage pumps, acting as asst. to water supply engr., Vancouver, 1944, same type of work, Edmonton, 1945, same duties, and at present res. engr., water supply and sewerage, 706 Tegler Bldg., Edmonton, Alta.

References: H. P. Keith, G. T. Chillcott, G. W. Parkinson, W. E. Crossley, E. K. Phillips.

STURDEE—CHARLES P., of Sarnia, Ont. Born at Montreal, Nov. 4th, 1910. Educ.: B.Eng., McGill Univ., 1934; R.P.E., Ontario; 1934-36, dftsman., designer, Imperial Oil Ltd., Montreal East; 1937-1941, sales mgr., Gilbert & Barker Co., Ltd., Toronto, mfrs. of gasoline pumps, service stn. equipt., burners, furnaces, high pressure grease equipt.; with Imperial Oil Limited, as follows: 1941-43, mechanical designer, genl. engrg. dept., Sarnia, work included physical design of pressure and vacuum vessels, piping systems, structl. steel, foundations, reinforced concrete equipt. layouts, etc., 1943 to date, process mech. development engr., engrg. dept., Sarnia, development and design of petroleum processes and equipt., specifying of mech. equipt., economic studies, etc., in connection with company's refining activities in Canada and South America.

References: G. L. Macpherson, C. P. Warkentin, G. W. Christie, J. W. MacDonald, E. W. Dill.

SWAN—DAVID, of 89 Smithfield Ave., W. Kildonan, Winnipeg, Man. Born at Regina, Sask., May 8th, 1914. Educ.: B.Sc. (Mech.Engrg.), Univ. of Saskatchewan, 1938; 1938-39, dftsman., Hotpoint divn., Canadian Genl. Electric, Toronto; 1939-40, jr. engr., Consolidated Paper Corp., Port Alfred, Que.; 1940-45, Capt., R.C.E.M.E.; and at present, chief engr., Kipp-Kelly, Ltd. Winnipeg, Man.

References: I. M. Fraser, N. Hutcheon, C. J. Mackenzie, G. A. Cowan, R. A. Spencer.

TURNER—GORDON CHESTER, of 285 Colborne St., N., Simcoe, Ont Born at Aylmer, Ont., Sept. 5th, 1913. Educ.: B.Aero.Engrg., Univ. of Detroit, 1940 (accredited E.C.P.D.); 1933-37 (summers), detail structl. dfting., asst. millwright; with R.C.A.F., as follows: 1940 (4 mos.), Aircraft Inspection Divn, School, 1940-42, Aero. Inspection Divn., inspectr. at Fleet Aircraft Ltd., Fort Erie, Ont., 1942 (5 mos.), Officer I/C of servicing squadron, responsible for servicing 108 aircraft, 1943 (7 mos.), Tech. Liaison Officer, Overseas H.Q., London, Eng., 1943 (5 mos.), Officer I/C Repair and Inspection Squadron, Heavy Bomber Station, operating 40 Halifax bombers and later 40 Lancaster bombers. Now demobilized.

References: J. Gilchrist, G. Minard, E. S. Braddell, R. C. Scott.

WALKER—CHARLES FREDERICK, of Three Rivers, Que. Born at Corinth, N.Y., Oct. 18th, 1909. Educ.: Mech. Eng., Cornell Univ., 1932 (accredited E.C.P.D.); with Canadian International Paper Company, as follows: 1933-34, heating and ventilation, Three Rivers mill, 1934-36, asst. steam plant supt., 1936-41, mtce. engr., 1941-44, asst. plant engr., and at present plant engr., Three Rivers mill.

References: K. S. Lebaron, C. H. Champion, G. B. Baxter, W. T. Bennett, J. F. Wickenden.

WHITTAKER—WILLIAM REUBEN, of 3480 Baldwin Ave., Montreal 5, Que. Born at Montreal, Jan. 7th, 1907. Educ.: Montreal Technical School (evenings), advanced mathematics and design; International Corr. Schools, mech. engrg.; with C.P.R., as follows: 1924-29, machine apprentice, Angus Shops, 1929-32, jr. dftsman., Windsor Street; 1934-36, compression plant operator, British American Oil Co., Ltd.; with Hydraulic Machinery Co., Ltd., as follows: 1937-39, sales engr. and estimator, 1939 to date, asst. chief engr.

References: E. Cowan, H. J. Roast, J. O'Halloran, E. F. Viberg, J. M. Fairbairn.

WINTERMARK—CHARLES ROAR, of 1487 Chomedy St., Montreal 25, Que. Born at Copenhagen, Denmark, Jan. 11th, 1890. Educ.: Diploma, Engr., Univ. of Mittwaida, Saxony, Germany, 1915; R.P.E., Ontario; 1905-09, apprenticeship as mechanic, Copenhagen Millstone and Machine Works; 1909-12, worked as skilled mechanic in Germany, Switzerland and England; 1915-25, dftsman. in Denmark and Germany; 1926, dftsman., Ottawa Car Mfg. Co., Ottawa, Ont.; 1926-27, dftsman., Montreal Water Board, Montreal; 1927-31, sr. dftsman., Can. Car & Foundry Co., Turcot Works, Montreal; 1931-36, mining surveyor, prospecting (placer mining), heating instalns., etc. (during depression); 1936-38, sr. dftsman. and checker, Dominion Engrg. Works; 1938-39, checker, Can. Car & Foundry Co., Mining Divn., Pt. St. Charles; 1939-40, dftsman., Defence Industries Ltd., Montreal; 1940-42, tool designer, Dominion Engrg. Works, Longueuil, Que.; 1942-43, chief tool designer, Armstrong, Wood & Co., Toronto, Ont.; 1943-44, tool and machine designer, Farand & Delorme, Ordnance Divn., Montreal; 1944-45, project engr., Army Engrg. Branch, Dept. Munitions & Supply, Montreal; 1945, mech. engr. and dftsman., Brompton Pulp & Paper Mill, Red Rock, Ont.; at present, mech. engr., Robert Mitchell Co., Montreal.

References: C. J. Desbaillets, E. F. Viberg, R. Wangel, G. A. Johnston.

FOR TRANSFER FROM JUNIOR

KELLAM—GEORGE DOUGLAS, of Calgary, Alta. Born at Montreal, Que., Feb. 23rd, 1911. Educ.: B.Sc. (Elect.Eng.), Univ. of Manitoba, 1933; R.P.E., Alberta; 1933-34, demonstrator, Univ. of Manitoba; 1934-35, Canadian mining projects; 1935-39, engr. i/c of pipe coating operations and cathodic protection, Cdn. West Natural Gas, Light, Heat & Power Co., Ltd.; 1939-45, R.C.E. with the rank of Staff Captain; at present, asst. engr., transmission system, Cdn. West Natural Gas, Light, Heat & Power, Calgary, Alta. (Jr. 1937.)

References: F. J. Heuperman, E. W. Bowness, F. A. Brownie, J. McMillan, A. B. Geddes, K. W. Mitchell.

FOR TRANSFER FROM STUDENT

BALCOM—ALFRED BURPEE, of Wolfville, N.S. Born at Port Williams, N.S., Dec. 15th, 1915. Educ.: B.Eng., McGill Univ., 1940; 1940-42, Belgo Divn., Consolidated Paper Corp.; 1942-45, R.C.N.V.R., with rank of Lieut. (E). (St. 1939.)

References: E. Brown, C. H. McKergow, A. R. Roberts, B. N. Cain.

EDSON—RALPH EVERETT, of 195 Wolseley Ave., Montreal West, Que. Born at Montreal, Sept. 2nd, 1913. Educ.: B.Eng., McGill Univ., 1936; with Canadian General Electric, as follows: 1936-37, test course, 1937-38, student engr., 1938-43, sales engr., electric apparatus; 1943-45, Canadian Army as E.M.E. Tele. Officer, Section Head, Power Section, Telecommunications Group, M.G.O. Branch, N.D.H.Q.; at present, app. sales engr., Canadian General Electric, Montreal. (St. 1937.)

References: G. H. Gillet, P. E. Rose, J. Cameron, J. S. Paterson.

KEELER—RUSSELL BRUCE, of 395 Garlies St., Winnipeg, Man. Born at Davidson, Sask., Aug. 6th, 1915. Educ.: B.Sc. (Civil Eng.), Univ. of Saskatchewan, 1941; 1938 (summer), rodman on Churchill River Water Survey, carried out by Northern Conservation Committee; 1943 to date, R.C.A.F., with rank of Engineering Officer. (St. 1941.)

References: R. A. Spencer, E. K. Phillips, N. B. Hutcheon, I. M. Fraser, C. J. Mackenzie.

LOMBARD—ROBERT ALEXANDER, of 107 Canal Road, Beauharnois, P.Q. Born at Malagash, N.S., July 31st, 1910. Educ.: B.Sc. (Elect. Engrg.), Nova Scotia Tech. Coll., 1932; 1932-39, engr. i/c of all elect. equipt., Malagash Salt Mine, Malagash, N.S.; 1939-40, trades training instructor, Sydney Apprenticeship Project, Sydney, N.S.; 1940-45, R.C.E., with rank of Captain, i/c elect. layout and design for buildings constructed for Canadian Army in U.K. Overseas 4 yrs., and at present released and seeking civilian employment. (St. 1932.)

References: P. N. Gross, A. E. Flynn, I. P. MacNab, J. W. McKiel, L. E. Mitchell.

ORLOFF—IRVING, of 75 St. Cross St., Winnipeg, Man. Born at Winnipeg, June 25th, 1921. Educ.: B.Sc. (Civil), Univ. of Manitoba, 1943; 1943-45, R.C.E., with rank of Lieut., special courses in special engrg. equipt., dozer, scraper, grader, etc., and in heavy bridging and pile driving; at present, asst. supt., i/c treating process, Pembina Mountain Clays, Ltd., Winnipeg, Man. (St. 1941.)

References: G. H. Herriot, A. E. Macdonald, W. F. Riddell, E. P. Fetherstonhaugh.

LIBRARY NOTES *(Continued from page 806)*

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 ON PLASTICS

Sponsored by A.S.T.M. Committee D-20 on Plastics. Specifications, Methods of Testing, Nomenclature, Definitions. May, 1945. American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. 542 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $2.75.

The third edition of this compilation contains more than 100 specifications and methods of testing of plastics. Twenty-four of these standards apply to plastics in the electrical insulation field. Nomenclature and definitions of and relating to the plastics field are included, and there are two standards covering thermometers.

BUILDING CONSTRUCTION ESTIMATING

By G. H. Cooper. McGraw-Hill Book Co., New York and London, 1945. 282 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $3.00.

The aim of this book is to present in orderly sequence a well-rounded course covering the everyday work of the building contractor's estimator. In addition to the technical and factual data for the actual estimating procedures, the book covers the relations of the estimator with the architect, subcontractors, workmen, etc., and something of the legal side of building work. Two sets of plans and outline specifications are included.

ELECTRO-PLATING, a Survey of Modern Practice, including the Analysis of Solutions

By S. Field and A. D. Weill. 5th ed. Pitman Publishing Corp., New York and Chicago, 1945. 483 pp., illus., diagrs., charts, tables, 7 x 5 in., cloth, $5.00.

The object of this book is to provide the practical plater with a review of the technical advances in his field. The first ten chapters are devoted to fundamental principles of chemistry, metallurgy, electricity and electrodeposition, and to the mechanical or chemical cleaning of metal surfaces. The following ten chapters give practical information for the deposition of specific metals and alloys. Metal colouring is briefly discussed in the final chapter.

INTERNAL-COMBUSTION ENGINES, Theory and Design

By V. L. Maleev. 2 ed. McGraw-Hill Book Co., New York and London, 1945. 636 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $5.00.

This second edition of a standard text gives the student a general foundation in the theory, design and operation of internal combustion engines. Five new chapters have been added: combustion in spark-ignition engines; combustion in compression-ignition engines; compression-ignition combustion chambers; supercharging; and gas turbines. An important feature of the book is the considerable amount of material dealing with design procedure.

INTRODUCTION TO MICROWAVES

By S. Ramo. McGraw-Hill Book Co., New York and London, 1945. 136 pp., diagrs., 8½ x 5¼ in., cloth, $1.75.

The author presents a simple, nonmathematical discussion of "microwaves", electricity with a frequency of alternation in billions of cycles per second. Physical pictures in the form of line diagrams are extensively used to illustrate the concepts discussed. The book is intended for both the beginner in the field and the non-specialist who wants a brief treatment of the subject.

PRACTICAL MANAGEMENT RESEARCH

By A. R. Wiren and C. Heyel. McGraw-Hill Book Co., New York and London, 1945. 222 pp., charts, tables, 9 x 5¾ in., cloth, $2.50.

This book discusses the use of scientific research techniques in business, giving in detail the theory, principles and methods for research into management problems. It describes the analysis of business problems and methods for conducting practical management and time studies. Part II presents case examples of the systematic solution of management problems selected from actual business experience.

PRINCIPLES OF PHYSICS III, Optics

By F. W. Sears. Addison-Wesley Press, Cambridge 43, Mass., 1945. 323 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.00.

This third volume of a series of physics textbooks covers the field of optics. As with the other volumes in the series, the emphasis is on physical principles. Historical background and practical applications are of secondary importance. Beginning with the nature and propagation of light, the successive chapters carry the subject from the general to the specific, concluding with separate treatments of polarization, line spectra, thermal radiation, photometry and colour.

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 Wanted

ELECTRICAL

ELECTRICAL ENGINEER with some construction experience is required for the technical staff of a power commission in western Canada. Preference will be given to a young man who is prepared to start at a moderate salary with the expectation of advancing with the expansion of the distribution of electrical energy in that province. Apply to Box No. 3179-V.

MECHANICAL

MECHANICAL ENGINEER, age 25 to 35, graduate, is required by a firm of consulting engineers in Montreal for work in connection with heating and ventilating. Salary for this position would be $200 to $250 a month depending on experience. Apply to Box No. 3164-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 DRAUGHTSMAN with enough experience to detail machines after rough instructions is required by a consulting engineer in Montreal for temporary work. Salary would be $200 to $225. Apply to Box No. 3170-V.

DRAUGHTSMAN with two or three years experience is required for temporary work with a firm in Montreal. This employer is willing to allow the successful candidate to use this position as a stop-gap while seeking permanent employment. Salary would be from $50 a week up, depending on experience. Apply to Box No. 3171-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.

MECHANICAL ENGINEER is required by a paper company on the lower St. Lawrence, for work in connection with mill maintenance and methods improvements for repair and machine shop work. Candidates should be 25 to 30 years of age and should have had from 4 to 6 years' experience, including some machine shop practice. Preference will be given to discharged service men and salary would be between $250 and $300 a month. Apply to Box No. 3181-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.

MISCELLANEOUS

ENGINEERING DRAUGHTSMAN, preferably graduate, is required by a firm of consulting engineers in Montreal for work in connection with heating and ventilating. Apply to Box No. 3164-V.

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.

SALES ENGINEER, not necessarily a graduate, is required for a firm of manufacturers of metal building products in the Montreal area. Preference will be given to discharged service men, 25 to 35 years old who have some technical background and salary will be about $250 a month. Apply to Box No. 3167-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.

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 surveying, on either highway or railway work, is required to locate about 15 miles of railway in northern Ontario. Salary would be from $350. according to qualifications. Apply to Box No. 3148-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.

ELECTRICAL ENGINEER, graduate, with a few years experience, age 28-30 is required by a mining company in Quebec for general work including layout and draughting. Apply to Box No. 3136-V.

MECHANICAL

MECHANICAL ENGINEER, preferably with some experience in the pulp and paper industry is required for draughting and design work with a pulp and paper company in the Lake St. John district at a salary of approximately $300. a month. Apply to Box No. 2941-V.

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.

TWO MECHANICAL ENGINEERS are required as mechanical superintendents with leading meat packing plant. Duties consist of supervising the operation of steam, refrigeration and electrical equipment, and the maintenance of all buildings and equipment. Positions available at Vancouver and Regina. Would prefer men with experience on similar work, under 40 years of age. Salary $220 to $280 a month depending on experience. Apply to Box No. 3083-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, graduate, age about 30, with two or three years draughting and design experience and overseas military service preferably in RCEME, with actual experience in a workshop on tanks, tractors, etc., is required to act as assistant to the chief engineer of a company engaged in the manufacture of newsprint with several mills in the province of Quebec. Candidates must be bilingual, tactful and resourceful. The work will involve investigation of maintenance problems, study of new wood-handling methods and a variety of engineering projects in the various mills. Salary will be $300.-$350 a month. Apply to Box No. 3024-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, bilingual, age 25-35 is required to act as plant engineer for a company engaged in the manufacture of brick and tile in the province of Quebec. Preference will be given to returned service man and salary would be about $200. a month. Apply to Box No. 3156-V.

MECHANICAL DRAUGHTSMAN, not necessarily a graduate but with some experience, is required by a company in Montreal for work on plant layouts and installations. Salary would be $175. to $225. a month depending on experience. Apply to Box No. 3157-V.

MECHANICAL OR CIVIL GRADUATE with two or three years' experience, age 25 to 35, preferably discharged service man is required to act as assistant engineer on plant layout work including machinery, rotary kilns, etc., by a company in Montreal. Position might eventually lead to sales work. Salary $200. to $250. depending on experience. Apply to Box No. 3158-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.

METALLURGICAL

METALLURGICAL 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.

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

RECENT GRADUATE in engineering is required to act as technical assistant for a firm of patent attorneys engaged in important industrial work in the Montreal area. Apply to Box No. 3061-V.

FIELD SERVICE ENGINEER, qualified to give instruction in shops or clinics on automotive electrical systems, carburetion systems and fuel systems for the service department of a firm interested in covering the province of Quebec and the Maritime provinces. Should be fluently bilingual. Apply to Box No. 3077-V.

TWO CIVIL OR MECHANICAL GRADUATES, preferably with some experience in plant layout work are required by a firm in eastern Quebec. Work would involve draughting at first with complete control of a process after some months. Candidates should be 25-35 years old and salary would be about $200 a month. Apply to Box No. 3079-V.

SEVERAL SALES ENGINEERS not necessarily graduates but with mechanical inclinations and good appearance, between the ages of 21 and 25, are required to be trained in Montreal by a firm engaged in the production of machine tools and machinery. Preference will be given to returned service men and salary would be from $150 a month up, depending on experience. Apply to Box No. 3085-V.

AERONAUTICAL ENGINEER with some experience, about 30 years old, required for stress analysis work by a company in the Montreal area. Apply to Box No. 3096-V.

INSTRUMENT MAN familiar with electrical systems of aircraft, not necessarily a graduate engineer, is required in the Montreal area for work in connection with problems of faulty installations, etc. Salary would be $200. a month. Preference will be given to qualified discharged service man. Apply to Box No. 3120-V.

GRADUATE ENGINEER in electrical, mechanical, mining or metallurgy, English-speaking with a good command of French, is required by a firm of manufacturers of abrasives and refractories, to operate a quarry and a sand mill near Montreal. Apply to Box No. 3122-V.

FORESTRY ENGINEER, graduate, 25-35 years old, preferably bilingual, returned service man is required by a newsprint manufacturer in the St. Maurice Valley. Apply to Box No. 3142-V.

ARCHITECTURAL DRAUGHTSMAN, not necessarily a graduate engineer, with four or five years' experience is required for temporary work with a large company in Montreal. Salary would be about $275. a month. Apply to Box No. 3143-V.

PUBLICITY MAN capable of looking after catalogues, photographs, advertising, and editing of a journal, with some technical knowledge and ability to write interesting articles on electrical installations, is required by a company in Montreal. Apply to Box No. 3151-V.

PLANT ENGINEER is required by a sulphite company in the province of Quebec, to be responsible for all mechanical and electrical maintenance and construction in mill and in connection with town lighting system. Successful applicant would act as consulting engineer for town and woods department. Candidates must have good experience and preference will be given to returned service man. Salary about $450. a month. Apply to Box No. 3152-V.

SALES ENGINEERS are required by a company in Montreal engaged in the manufacture of insulating materials. Candidates must have technical education and preferably some plant operating and sales experience. Conversational knowledge of French desirable. Salary would be $200-$225 a month plus commissions. Apply to Box No. 2993-V.

SEVERAL ENGINEERING DRAUGHTSMEN, preferably ex-service men, 30 years or younger, are required by a Canadian newsprint manufacturer. Salary would be between $160 and $250 a month depending on experience. Apply to Box No. 3023-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.

MECHANICAL ENGINEER, age 34, Lt. (E) R.C.N.V.R., soon to be discharged. Experience, 6 years heavy maintenance on railroads, 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 R.C.N.V.R. of which 20 months have been at sea. Thorough knowledge of machine and boiler shops, able to plan and to handle men. Registered with W.B.T.P. Apply to Box No. 2456-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 METALLURGICAL ENGINEER, age 25, available immediately. Canadian, bilingual, desires employment in Montreal or vicinity. Willing to travel occasionally. Experience in light metals and gray cast iron metallurgy, foundry practice. Has held responsible position in charge of production industrial engineering, buying, supervisory experience. Would consider employment with industrial consultants or with progressive engineering organizations or in sales. Apply to Box No. 2554-W.

MECHANICAL ENGINEER, graduate, 42, married, bilingual, 18 years' experience in foundry in charge of production. Familiar with plant layout, executive ability and experienced in handling men, desires to secure position with plant where ability could be recognized. Available immediately, location immaterial. Apply to Box No. 2555-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.

PARTNER WANTED, McGill graduate, B.Sc. '23 just returned from overseas service, having pre-war experience as part-owner of small metal-working shop, is considering setting up small mechanical and/or electrical manufacturing business in Montreal and wishes to meet one or two persons (preferably engineering graduates) who might be interested in active partnership, for purposes of preliminary discussions. Alternatively, advertiser would consider taking active interest in an existing business. Apply to Box No. 2559-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.

MECHANICAL ENGINEER, B.Eng. (McGill), S.E.I.C., age 25, single, bilingual; one year mechanical experience in paper mills, including machine shop and maintenance work. Presently serving overseas with R.C.E.M.E. Two years army experience in machine shop supervision and motor transport overhaul and maintenance. Not available till released from Army but wishes to make contacts for post-war position preferably in province of Quebec. Apply to Box No. 2561-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

Industrial Promotion Engineer

Graduate engineer, preferably between 35 and 45 years of age, required by large corporation, for the promotion of industrial power sales. Must have a basic knowledge of electricity, general experience in industry and a good business background. Knowledge of French essential. Creative imagination and ability to investigate industrial development are prime requisites. When applying, submit recent photograph, with details of education and experience. Apply to Box No. 3154-V.

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.

WANTED

Chief Draughtsman experienced in all types of structural work, who can take charge of a draughting office for a Central Ontario city. Please state experience and salary expected. Apply to Box No. 3185-V.

ENGINEER WANTED

District Engineer for the Water Rights Branch, Public Service Commission of Saskatchewan. Must be graduate in civil engineering from a university of recognized standing, with at least three years of proficient technical experience, preferably in surveying and hydraulic work. Under supervision, to direct field surveys in connection with irrigation and power projects; make studies, estimates and reports and prepare designs, plans and specifications. Travelling required. Headquarters at Saskatoon or Prince Albert.

For application forms and further particulars write Secretary, Public Service Commission, Legislative Buildings, Regina, Saskatchewan.

WANTED

Aeronautical Engineer, graduate of recognized university, preferably with wind tunnel and aircraft design experience. Salary according to qualifications. Must be available under the provision of Order-in-Council P.C. 2796, Part 3, technical personnel, administered by Wartime Bureau of Technical Personnel. Apply to Box No. 3176-V.