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The Canadian Engineer

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The Fuels of Canada

Habitability of Certain Now Populated Sections of Canada Depends Upon the Efforts of Canadian Engineers in Bettering the Fuel Situation—Stirring Address at Annual Meeting of Canadian Society of Civil Engineers

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IF the violent rupture of the peaceful conditions existing some four years ago had not occurred, it is very doubtful whether the subject of fuels would attract any special attention to-day, unless, perhaps, a discussion of such a subject disclosed new fields for profitable exploitation. To-day, however, the attention of the people of this country is forcibly centered on this very subject; because we are realizing, perhaps for the first time, our dependence, to so large an extent, on the United States for this essential commodity, and, further, are beginning to understand that our supply of fuels from that country may be cut off at any time.

In the past, and up to the present, we have been depending largely on fuels mined and prepared for the market by labor over which we have absolutely no control. As a consequence, we are at the mercy of foreign strikes and industrial disorganization, and either one or both of these are liable to occur.

A strike of coal miners, or a railroad strike in the United States would affect Canada more seriously in certain respects than the States, since in Canada we would not have the advantage of accumulated reserves which the United States would be certain to have in normal times.

But, there is even a more important factor which we must consider, *viz.*, the necessity which may occur for the United States to keep her fuels within her own country. Such a situation may not arise for some time, but the indications are that we may have to meet such an emergency in the near future.

Canada, to-day, is facing a fuel situation of great gravity; a situation which has not been created by any special conditions in this country, but by those obtaining in the neighboring country. The United States is suffering from a shortage of fuels as a result of the withdrawal of skilled labor from the coal mines to other occupations, and, perhaps more directly, to the abnormal demand on the transportation facilities of that country for the carrying of material directly connected with the conduct of the war.

We are not wholly dependent on the United States for our fuel supply, but we are dependent to the extent of 55 per cent. of our total coal requirements and 98½ per cent. of our crude and refined oil products. Large and important sections of Canada, moreover, are almost wholly dependent on imported coal for house-heating purposes. This is a matter for grave reflection, since in a country such as ours, where artificial heat must be supplied during eight months of the year for the sole purpose of maintaining life, a continuous and dependable supply of fuel is absolutely essential.

The fuel situation existing in Canada to-day is due to the ease with which fuels of all kinds, suitable for every requirement, were imported from the United States, and to the apathy displayed towards the exploitation of certain of our own fuel resources by the public at large.

We have not exploited our fuel resources, with the exception of wood, on an extravagant scale, but, on the contrary, we have been culpably neglectful of these vast stores of energy, insofar as we have failed to provide for the future by learning how to use our low-grade fuels, on which at no distant time we shall have to depend. The result of this neglect to improve our position and render ourselves independent, as far as possible, will be great suffering to the people of Canada, in the event of a stoppage of fuel supplies from the United States, if we do not, at once, take steps to render our own fuel resources available for our own needs.

The present unsatisfactory—indeed alarming—situation can only be improved by a determined and energetic exploitation and utilization of our own vast fuel resources.

I am prepared to show that Canada does possess abundant supplies of fuels, favorably situated, and that these can be exploited in such a manner as to render her much less dependent on, if not entirely independent of, foreign sources for her fuel supply.

Before enquiring into our fuel possibilities, it is necessary to state and analyze our annual fuel requirements.

Canada's Fuel Requirements

The total fuel requirements of this country during the year 1916 amounted to nearly 30,000,000 tons of coal; 299,426,121 Imperial gallons of crude and refined oil products, and firewood valued approximately at \$60,000,000.

The railways burned 9,000,000 tons of bituminous coal; 7,000,000 tons were probably required for the purpose of generating power, and a large quantity was used for making retort or town gas, heating large buildings, and the manufacture of coke. Over 4,000,000 tons of anthracite were burned in domestic and other heating plants, and, to some extent, were used for industrial purposes. In normal times, practically the entire imports of anthracite coal are used for heating purposes.

Compared with her annual requirements, Canada's production of fuels for the same period amounted to 14,483,395 tons of bituminous coal, of which 2,135,359 tons were exported; 6,934,288 Imperial gallons of crude oil, and wood fuel to the value of \$60,000,000. To meet our own needs, therefore, it was necessary to import 17,580,603 tons of coal, and 292,426,121 Imperial gallons of crude and refined oil products.

Of this quantity of oil, approximately 50,000,000 gallons were used on the railroads; 30,000,000 gallons for steamships, and the remainder, 210,000,000 gallons, was used for lighting and heating, in the form of kerosene and, to a large extent, in the form of gasolene, for power purposes.

This is a general statement of the extent of our dependency on the United States for these essential commodities.

An analysis of our fuel resources, their location and extent, will reveal the reason for the necessity of these excessive imports.

The Fuel Resources of Canada

The fuel resources of Canada exist in the vast coal fields of the extreme eastern and western portions of Canada; the lignite fields of the western provinces; the natural gas fields of Western Canada, and the province of Ontario; the petroleum fields of Ontario; the oil shales of New Brunswick, Nova Scotia, and elsewhere; the standing forests, and, last, but not by any means the least important, the great areas of peat bogs. This is a truly formidable array of resources. Now, let us enquire into their extent, quality, and location, since these are the most important factors concerning their exploitation.

The following is an estimate of the actual coal reserves of Canada, based on actual thickness and known extent. The location and approximate classification of the coals are also designated:—

Nova Scotia	2,137	million tons of bituminous coal.
	50	" " cannel coal.
Saskatchewan ..	2,412	" " lignite.
Alberta	382,500	" " lignite or sub-bituminous.
	1,197	" " low carbon bituminous coal
	•	" " "
	2,026	" " anthracite and bituminous.
	669	" " semi-anthracite.
British Columbia	23,653	" " semi-anthracite & bituminous.
	118	" " low carbon bituminous coal.
	60	" " lignite.

In addition to these admittedly great reserves, we have in this country 37,000 square miles covered with peat bogs. The total estimated tonnage of fuel represented in this area is 28,000 million tons of 25 per cent. moisture peat fuel, equivalent, on the basis of actual heating value, to about 16,000 million tons of good coal. Of this total area, however, only a portion is favorably situated with respect to economic development. Twelve thousand square miles of peat bogs are distributed throughout the central provinces: Manitoba, Ontario, Quebec, and New Brunswick, and the estimated tonnage of peat in this area is 16,000 million tons, equivalent, on the basis of actual heating value, to 9,000 million tons of coal.

No estimate can be made of the forests of Canada which are available for firewood, and natural gas has a special value only in those districts which can be economically served with this fuel. Natural gas is of great value when it can be obtained in large quantities in well populated and industrial communities, but it possesses the disadvantage of being an uncertain source of heat.

Of petroleum, all that I shall say, at the present time, is that Canada is manifestly not a petroleum-producing country.

The principal fuel resources, then, which we have to consider are the bituminous and anthracite coals, the lignites, and peat. Oil shales and other sources of oils will be considered later.

The statement of the distribution of our fuel resources discloses the fact, that the true coals are situated in the extreme east and west, and the western part of Alberta; the lignite coals are situated in the provinces of Alberta and Saskatchewan, but lying between the limits of these deposits is a great stretch of territory devoid of coal measure of economic value. The 12,000 square miles of peat bogs are situated in this area.

The country naturally lends itself to a division into four parts or districts, and each district has an abundance of fuel peculiar to its own area. The first district embraces that portion of Western Canada which can be economically supplied with bituminous and anthracite coals; the second district, that area which can be supplied with lignite; the fourth area, that portion of Canada which can enjoy the full advantages of Nova Scotia coal. The third district cannot be economically supplied with any of the above coals. This area must either render itself independent of foreign fuel sources by developing and utilizing its excellent peat bogs, or remain, to a large extent, dependent on the United States. A large portion of the province of Ontario is principally affected in this manner.

To supply certain of these areas with fuel of the desired quantity and of a quality suitable for various purposes, constitutes a problem which must be satisfactorily solved before we can improve our fuel situation.

The bituminous coals of Canada are similar to those of the United States, and include large quantities of excellent coking coal. Their utilization for general industrial purposes presents no difficulties whatever, but for domestic purposes bituminous coal, in its raw state, is far inferior to anthracite, which is the fuel almost entirely used for these purposes in Canada. A most excellent fuel, practically the equal of anthracite, can, however, be produced from bituminous coal by a special process consisting of carbonization at low temperature and briquetting. This process is in actual operation to-day turning out briquettes of this description, entirely satisfactory for domestic purposes.

With lignite and peat, however, the situation is totally different. In their raw state, peat and a large portion of the lignite are not suitable for use. These fuels must be submitted to some preliminary treatment before they can be utilized for general fuel purposes.

When the peat deposits of the central provinces, and the lignites of Saskatchewan and Alberta are rendered into forms convenient and suitable for domestic and industrial purposes, the fuel situation, so far as Canada is concerned, will have been greatly improved.

Before treating these two fuels in detail, it is necessary to draw your attention to the fact that the transcontinental railways traversing the western provinces are prohibited by an order of the Railway Commission from burning lignite in the locomotives during the summer months. These railways, on their west-bound trips, are consequently compelled to burn imported coal to that point in the western coal fields where they can again replenish their tenders with native bituminous coal. The same thing takes place on that portion of the eastbound trip traversing the province of Ontario.

Apart from this order issued by the Railway Commission, the railways would much prefer to haul and burn imported coal, inasmuch as lignites—at least certain of them—are not suitable for locomotive use.

The railways of Ontario also are entirely dependent on imported coal.

Preparation of Lignite and Peat for Economic Utilization

The utilization of certain of the lignites for some purposes is possible without any subsequent treatment. With others, however, notably those of Saskatchewan, the lignites as mined are not suitable for use. This is due to the physical and chemical properties peculiar to this type of fuel.

Lignites usually contain large quantities of moisture, ranging from 16 to 35 per cent. of the weight of the fuel, and the evaporation of this moisture, whether by natural or artificial agencies, results in the disintegration of the fuel. This disintegration, however, does not discontinue when the evaporation of the moisture is complete, but appears to go on indefinitely.

One more peculiarity must be mentioned, *viz.*, the dangerous sparks emitted from the stacks of locomotives when lignite is burned. These sparks, when they emerge from the stack, burn with a small flame and this flame is not extinguished by its passage through the air, as is the case with bituminous coal or anthracite coal sparks, but continues to burn after lighting on the ground. On account of this dangerous property, lignites cannot be safely burned in locomotives.

Lignite, unlike the true coals—bituminous and anthracite—lacks definite structure. (This term is employed in its physical sense.) To this may be attributed the reason for the difficulty with which lignites submit to mechanical treatment.

The characteristics of lignites must be altered before they can be converted into a satisfactory fuel. Experiments on a commercial scale have demonstrated beyond doubt the fact that our lignites cannot be briquetted in the raw state with or without the addition of a binder. Briquettes made in this manner appear, on casual examination, to be entirely satisfactory, but when submitted to a water test, or when burned, they will invariably disintegrate.

The characteristics of a lignite are changed by carbonizing it at low temperature. During this process, the moisture and volatile matter are completely distilled off, and there remains in the retort a residue composed of practically pure carbon. This residue is then mixed with a suitable binder, and briquetted. In order to render this briquette waterproof, a second heat treatment, or baking, is necessary. A fuel entirely satisfactory in every way, waterproof, capable of resisting disintegration when exposed to the weather, standing rough handling without breaking, not emitting flaming sparks, and capable of maintaining its physical structure or shape under the action of heat until completely consumed, has been produced by such a process. In order to demonstrate that this process will solve the problem in connection with our western lignites, it is advisable to erect a commercial plant capable of producing one or two hundred tons of lignite briquettes per day. Such a plant would have to be equipped in such a manner as to allow of a certain amount of experimental work being performed, *e.g.*, in connection with binders.

I am of the opinion that it would require only a comparatively small amount of money, *i.e.*, compared with the immense value which the solution of this vitally important problem would be to the country—to successfully demonstrate that the lignites of the west could, by means of such a process, be converted into a fuel entirely satisfactory for a domestic and industrial purposes.

The establishment of briquetting plants at strategic points throughout the lignite provinces of the west would very greatly help in reducing our dependency for fuels on other sources. While a domestic fuel is, of course, of first importance, lignite briquetting industries would prove also of great value to the railways traversing the lignite belts. It would even be within the realm of possibility to economically supply at least a portion of the province of Ontario with this class of fuel.

The only remaining low-grade fuel to consider is peat.

Peat Fuel

The exploitation of our peat resources for the manufacture of a fuel does not involve any research work or experimentation. An economic process for the manufacture of raw peat into an excellent fuel suitable for domestic and, to some extent, industrial purposes, is in use to-day, and has been employed for many years in the peat-using countries of Europe. There is a flourishing and extensive peat industry in several of the European countries, but, in Canada, a country possessed of magnificent peat resources, and dependent to so large an extent on foreign supplies of coal, no peat industry exists. This deplorable state of affairs is due to misdirected energy in connection with the many attempts made to manufacture a fuel from peat, and to a general lack of interest towards anything connected with "peat" by the influential men of Canada.

Whether or not a particular natural substance shall be exploited has usually been decided from a "profit" point of view. Peat, not holding out great prospects for fabulous profits, failed to attract the attention of the large capitalists and industrial men. The creation of a peat industry was, therefore, left to the mercy of a few earnest and honest men with insufficient capital to prosecute an undertaking of this kind to a successful issue, and to a few fakirs and otherwise unscrupulous promoters, whose sole aim and purpose was "to get away with the money" before being discovered. Without going into detail, it will suffice to say, that several attempts have been made and as many failures with loss of capital involved have been recorded; but the larger portion of the capital lost could have been saved and a flourishing peat industry long ago established, if the promoters had been advised by accredited engineers who understood their business. Instead, however, of profiting by the experience of European investigators—gained at great expense—money was expended in developing and trying out ideas which had long before been discarded as impracticable, and, in many cases, impossible, by the investigators and engineers of the peat-using countries of Europe. Not until the results of the investigations conducted by the Mines Branch of the Department of Mines concerning the economic methods employed for the manufacture of peat fuel in European countries were placed at the disposal of the public, were men with impractical ideas dissuaded from interesting people in their schemes. Men of this description are still found going from place to place in a vain endeavor to interest capital, but they are rapidly disappearing.

Not until the utilization of a natural substance is forced by absolute necessity, will the most sincere and earnest efforts be put forth to successfully and economically convert it into a usable product. It appears to me that the time is at hand when necessity will decide that we Canadians utilize our peat resources, and in the most efficient manner.

Peat, in its natural state, is generally associated with about nine times its weight of water. It is, therefore,

evident that 1,800 pounds of water must be removed in order to recover 200 lbs. of solid matter. Moreover, this solid matter not only represents the combustible substance, but also the ash and mineral matter which is associated with the peat.

The separation of this large quantity of water, and the handling of so large a quantity of raw peat substance, in order to obtain a comparatively small quantity of combustible matter, represent the difficulties with which we are confronted when an attempt is made to manufacture peat into a fuel, on a commercial basis, and in a thoroughly economic manner.

The only economic process in existence to-day is that which employs the forces of Nature—the sun and the wind—for the removal of the moisture. The process employing these forces is called the “wet process,” and the product obtained is termed “machine peat.” This is the process which the Mines Branch, Department of Mines, demonstrated at the government peat plant at Alfred, Ont.

We not only have the process for manufacturing peat fuel, but also sufficient detailed information concerning peat bogs of immediate importance, to make a good start in the formation of a peat industry.

During the period covering the past ten years, the Mines Branch has completely investigated and mapped 58 Canadian bogs, all of which are situated conveniently with respect to inhabited and industrial communities, and also well situated with respect to railway and other transportation facilities. The investigations are conducted with a view to determining the principal and controlling characteristics of a bog, *viz.*, its area, depth, quality at different depths, quantity in tons, and, in general, its suitability for any particular purpose. The area examined in detail comprises 170,000 acres, and represents a quantity of standard peat fuel, *i.e.*, fuel containing 25 per cent. moisture, estimated at 120,000,000 tons. Seven bogs conveniently situated with respect to Toronto could supply that city with 26,500,000 tons of fuel, and seven bogs in easy reach of Montreal could supply 23,500,000 tons of fuel. Excellent bogs are, likewise, conveniently situated with respect to thickly inhabited communities, in Nova Scotia, New Brunswick, and other parts of Canada. This completes our inventory of the solid fuels. In regard to oil, we are not so favorably situated.

Sources of Oil

The oil fields of Ontario, the oil shales of New Brunswick, Nova Scotia and elsewhere and the bituminous coals and lignites constitute the only economic sources of oil known to exist at the present time. Energetic and intelligent prospecting directed by able petroleum geologists may disclose new oil fields of economic importance. This, however, must be accomplished before the above statement of our oil resources can be modified.

The productivity of the oil fields of Ontario is decreasing at so rapid a rate that it will be comparatively only a short time before they will cease to be a source of oil.

The oil shales of New Brunswick and Nova Scotia are, on the other hand, a most valuable source of oil. They are of large extent and rich in oil. The average oil content of a large number of samples representing various portions of the New Brunswick shale deposits is from 35 to 40 Imperial gallons per ton and if these samples are representative of the entire deposits, the total quantity of oil contained in these shales is very large.

Our bituminous coals and lignites also may become important sources of oil. The yields of benzol and tar from one ton of bituminous coal when coked in a by-

product recovery oven are respectively $1\frac{1}{2}$ and 5 gallons. The maximum yield of oil which might be expected when lignites are distilled solely for this purpose is probably not more than 3 per cent. of the weight of the fuel distilled. This figure may be subject to change; but the results of the work so far completed by the Mines Branch in connection with an investigation concerning the value of lignites as a source of oil do not indicate that a higher yield can be expected.

The total quantity of coal coked in Canada during 1915 was 1,856,393 tons, and if this quantity were coked in by-product coke ovens the yields of benzol and tar would be 2,800,000 and 9,000,000 gallons respectively. This yield of benzol could be further increased by distilling the tar recovered. The maximum quantity of benzol which could be recovered from the above quantity of coal is about 3,712,786 gallons.

The yield of light and heavy oils from 1 ton of bituminous coal is considerably increased when this coal is carbonized at low temperature.

Our oil requirements, as stated before, were, in 1916, nearly 300,000,000 Imperial gallons, while our domestic production was less than 7,000,000 gallons. A small quantity of benzol also was recovered in the by-product coke ovens operated during that year. In order, therefore, to produce sufficient oil to equal our imports of this commodity, we would have to distil an enormous quantity of coal and lignite, or oil shales, or both. The production of 300,000,000 gallons of oil from lignite would necessitate the distillation of about 30,000,000 tons of this fuel. This is manifestly impracticable.

As far as the oil shales are concerned, their distillation on a very large scale is not only entirely practicable, but very desirable. Large plants for the distillation of oil shale are in continuous operation in Scotland, and such plants were in operation in France prior to the war. Our shales are in no sense inferior to those of Scotland and could be exploited as easily and as profitably. No sound reason, therefore, exists for allowing this valuable source of oil to lie undeveloped.

Our domestic production of oil cannot be increased without great effort and the expenditure of considerable money, but provision must be made, and immediately, to provide against the time, not far distant, when the United States will be compelled to cease exporting her crude and refined oil products.

This will be forcibly brought into evidence by the following statement regarding the present status and future outlook of the oil industry in the United States. The production of oil, from 1859 to the year 1915, was 3,616,561,244 barrels, of 43 gallons to the barrel, and the possible future production is estimated at 7,629,000,000 barrels. This estimate was prepared for Senate Document 310, and was made by 30 prominent petroleum geologists of the United States Geological Survey. The United States, up to the year 1915, had exhausted 32 per cent. of her possible petroleum resources. If the present annual production is maintained, but not increased, her total crude oil supplies will be exhausted in less than 30 years. But, if the present rate of increase of production is maintained, total exhaustion will occur in a much shorter time.

It is apparent, then, that we will not be allowed to enjoy the advantages of the oil resources of the United States for a great while longer.

We can scarcely hope, for some time to come, to produce oil on a scale comparable with our demands—but we can appreciably reduce the quantity which must be imported and when oil can no longer be imported we will

simply have to reduce our requirements or else find a substitute.

Our total oil production from all sources might probably be increased to 120,000,000 gallons; by erecting oil shale distillation plants in New Brunswick with a combined capacity of 100,000,000 gallons and by increasing the quantity of coal coked in by-product ovens or by carbonizing large quantities of bituminous coal at low temperature and briquetting the carbonized residue.

The low temperature carbonization and briquetting of Nova Scotia coal either in Nova Scotia or at some centre of distribution favorably situated with respect to water transportation, as Montreal for example, would not only appreciably increase our production of oils, but would also be the means of supplying, for domestic purposes, a coal equal in many respects to anthracite. The fuel situation of some parts, at least, of Ontario might, in this manner, be much improved.

If this idea were carried out, our oil production would be:—

	Gallons
From oil shales	100,000,000
“ coke ovens and low temp. carbonization	14,000,000
“ Ontario petroleum fields	6,000,000
	120,000,000

This completes the survey of our fuel resources and our fuel situation as it exists to-day. The fuel situation of the future will depend on the efforts we make to render our own fuel supplies available for utilization by the people.

Economic Utilization of Our Fuels

I desire now to deal with the methods to be employed for the utilization of fuels in general, in order to convert the maximum of their heat energy into usable forms of energy, and to recover the maximum of the valuable chemical compounds which can be obtained from the solid fuels.

All of the solid fuels contain the element nitrogen, some to a very large extent, and this is the basic element of a most important chemical compound—ammonium sulphate. In normal times this substance is used very extensively for agricultural purposes, in order to restore to the exhausted wheat fields and other agricultural lands the essential nitrogen which has been removed, almost to exhaustion in certain instances, by the repeated raising of the same crops.

The necessity for employing such a fertilizer on our western wheat fields may not be apparent to everyone, because of the large increase in our wheat production reported from year to year. This is directly due to the large crops realized from the new virgin fields which are put under cultivation each year. The average yield per acre of the older wheat fields, however, is rapidly decreasing, and if their production is to be maintained or increased an artificial fertilizer will have to be employed.

This fertilizer is, however, in great demand in other countries, and its recovery in Canada and sale to other countries would, in many cases, prove to be a profitable venture.

The solid fuels are burned on a large and continually increasing scale for the production of power, town or retort gas, for the manufacture of metallurgical coke, and for general heating purposes.

The employment of the by-product recovery coke oven for the manufacture of metallurgical coke is taking place on a large and rapidly increasing scale in the United States, and Canada is now employing such ovens to a con-

siderable extent. The manufacture of coke in by-product ovens is attended with the recovery of ammonia and the oils previously referred to. The entire quantity of coal used for coke and gas making should be utilized according to this method.

Power, other than hydro-electric, can be produced from the solid fuels in two principal ways: through the media of, first, the steam generator, and steam engine; second, the gas producer and gas engine.

When the energy of coal is converted into useful work by the first method, all valuable by-products are forever lost. When the second method is employed, and the producer is of the by-product-recovery type, it is possible to realize a maximum recovery of the nitrogen content of the fuel. The thermal efficiency obtainable with the latter is also considerably higher than can be realized with the steam power plant.

The producer gas by-product recovery plant is eminently suitable for the production of a power and industrial gas, and the field of its application might be extended to include the supply of gas for certain domestic purposes, e.g., general heating. Such a gas possesses the advantage of low cost, inasmuch as the plant can be situated at or near the source of fuel. Moreover, the cost of operating the plant can be appreciably reduced through the sale of the by-products and this results in a further reduction of the cost of the gas per 1,000 cu. ft., if the production of gas is the main purpose.

We, however, possess sources of fuels especially high in nitrogen, viz., the peat bogs. The average nitrogen content of all the peat bogs so far examined is high—but there are a few notable peat bogs of large extent, containing fuel of excellent quality, in which the nitrogen content is very high. The fuel of such bogs should unquestionably be utilized in by-product recovery producer gas plants, for the production of power or a power, industrial, and domestic gas. The bogs referred to and described in detail in Mines Branch Report 299, are favorably situated with regard to populated communities and industrial centres.

Some of our fuels are especially valuable for purposes for which no other fuel can be substituted. This is especially the case in the coking variety of bituminous coals, and these fuels, at the present time, are being used indiscriminately for all purposes, notwithstanding the fact that the coking coals are invaluable for many metallurgical purposes and cannot be replaced, by any means known to-day, with non-coking coal. A coking coal should, therefore, never be used for any purpose for which a non-coking coal will be entirely suitable.

The quantity of coke produced in Canada to-day is small, and the necessity for conserving this class of coal may not be apparent. The great demand, however, for metallurgical coke in the United States and the probable depletion in the not far distant future of the supplies of this fuel in that country will, in time, make our deposits of coking coal of special value. When that time arrives, we shall have an excellent commodity for purposes of barter, if we now take steps to conserve our supplies.

The problems associated with the distribution of fuel to the various parts of Canada are somewhat complicated, owing to the distribution of its population. In order to supply heat and power in the most economical manner and at the lowest cost to a population so widely scattered, the most rigid economy must be installed. The added cost to a fuel consequent on large rail haulage and local distribution can be very materially reduced by centralizing heating and power plants.

The populated sections of the country should be carefully studied with a view to its logical division into sections, each of which could be economically supplied with heat and power by one central heating or power plant. If this were carefully followed out, very marked economy would result in both the use of the fuel and its cost to consumer. The difficulties entailed in the distribution of the required fuel for such communities would, at the same time, be very largely overcome.

Many of our industrial plants have been located without any regard to the source of power or fuel on which they depend. Such industries, wherever it is possible to do so, should be moved to a locality which can be economically served with hydro-electric energy or electric energy generated in a large central plant, and industrial sites in general should be set aside for the location of all future industries.

It is evident that our fuels cannot be used indiscriminately and without the exercise of some degree of intelligence. We must not only meet all our own fuel requirements and place the people of this country in such position that they will not need to worry about a possible coal

famine, but we must, at the same time, utilize our fuels in the most advantageous and economic manner. Great as our fuel resources are, we must practise conservation. Only by doing this do nations become strong and powerful.

The fuel situation of Canada, as I view it, is not a gloomy or discouraging one, for we are endowed with fuel deposits on a magnificent scale. All that is necessary now is that their proper exploitation and economic use be assured.

It will, therefore, be the duty of the engineering societies represented by your society and others to produce the necessary and unremitting pressure upon the proper authorities to give effect to your recommendations for the betterment of our fuel situation, so that Canada may be, for years to come, relieved from the ever-recurring anxiety of where the next year's fuel supply is to come from.

You can readily understand that the task before you, as engineers, is a difficult one, but one of the greatest possible importance, for the habitability of certain now populated sections of Canada depend upon the success of your efforts.

Abstracts from Branch Reports, Can. Soc. C. E.

OTTAWA

ALTHOUGH war conditions have vitally affected the activities of the Ottawa branch, the past year has been a very successful one. The strictest economy has been practised. We are still without permanent quarters, and as a result, the branch has a surplus of approximately \$1,200.

There have been many changes in our membership during 1917, due largely to the movement of engineers employed in the various government departments. The membership now totals 272, of whom about 63 are now on active service.

There has been a large and representative attendance at all of our regular meetings. The following is a list of the meetings during the year:—

Evening Meetings: February 15th, "Light vs. Illumination," J. W. Loomis; March 9th, "Front Line Communications," Major T. E. Powers; March 15th, "Storage Dams on Ottawa and St. Lawrence," C. R. Coutlee; April 12th, "Municipal Engineering," A. F. Macallum; May 10th, "141st Meridian," J. D. Craig; September 7th, "Optic and Acoustic Principles of Lighthouse and Fog Alarm Apparatus," Lieut.-Col. W. P. Anderson and F. P. Jennings; October 20th, "Mechanical Filtration," H. L. Seymour; November 29th, "Geology as Applied to Civil Engineering," W. J. Dick; December 13th, "Coal Gas," F. Elcock; December 20th, "Quebec Bridge," Lieut.-Col. C. N. Monsarrat.

Luncheon Meetings: February 1st, "Some of the Ways in Which the Engineer May Assist in the Development of Canada," Col. J. S. Dennis; March 1st, "Agriculture and the Engineer," Hon. Martin Burrell; March 29th, "The Present Status of the Engineer in Canada," W. F. Tye; April 26th, "Manufacture of Munitions as a Permanent Asset to Canadian Industry," Col. D. Carnegie; October 20th, "Mechanical Filtration," H. L. Seymour; November 15th, "The Awakening Recognition of the Engineer," F. S. Keith.

During the year the managing committee appointed an official librarian to be responsible for the books and records of the branch. The librarian is collecting and maintaining a complete set of government publications appurtenant to engineering. A special effort has been made to secure appropriate contributions from members of the society. Special reference in this connection should be made to a valuable donation from Sir John Kennedy, for which the Ottawa Branch is very grateful.

The annual meeting of the branch was held January 11th, when the following officers and members of the managing committee were elected:—

Chairman, G. Gordon Gale; secretary-treasurer, J. B. Challies; managing committee, S. J. Fortin, J. H. McLaren, W. F. M. Bryce, W. J. Dick and E. B. Post.

QUEBEC

AT the annual meeting of branch, held January 14th, the following officers were elected: Chairman, A. E. Doucet; secretary-treasurer, W. Lefebvre; members of committee, Alexander Fraser, J. E. Gibault and A. B. Normandin.

The branch had six meetings during the year, which were fairly well attended. The uppermost subject at most of the meetings was that of the betterment of the engineering profession, it being held of vital importance to the society that any person seeking admission should have the proper qualifications, and that, insofar as the province of Quebec is concerned, no admission should be made except in strict accordance with the terms of the provincial charter. In the opinion of the members of the Quebec Branch it is most desirable that a list of schools of engineering recognized by the council of the society should be prepared and sent out to the branches.

During the course of the year the following lectures were given:—

"Making and Filling of Shrapnel Shells," by Martin M. Wolff; "Report of the Proposed Amendments to the By-laws to be Submitted to the Provincial Government,"

by A. R. Decary; "The Flooding of the Chaudiere River on the 31st July, 1917," by A. E. Evans.

The financial standing of the branch is satisfactory owing to strict economy practised and largely due to the kindness of the mayor of Quebec in placing a convenient room in the city hall at the exclusive disposal of the branch members.

The membership of the branch totals 108.

TORONTO

THE Toronto Branch, notwithstanding the fact that 33 $\frac{1}{3}$ per cent. of the membership are on active service, had a successful year. The executive committee held 20 meetings. In addition to this, 8 open meetings were held at which the following papers were presented:—

"Labrador Revisited," Prof. A. P. Coleman; "The Work of the Canadian Engineer at the Front," Capt. Mathieson; "Venezuela and the Islands of the Caribbean Sea," H. K. Wicksteed; motion pictures, the water-powers of Canada.

The membership of the branch totals 316.

During the year a committee was elected to draft by-laws for the branch and study means for increasing the prestige and influence of the branch. By-laws have been adopted in consequence of this committee's work.

A committee on roads and pavements has presented a report on their activities.

The report of the library committee made special mention of gifts from Sir John Kennedy and the Ottawa Branch, which were much appreciated.

At the annual meeting held January 15th, the following officers were elected:—

Chairman, Prof. Peter Gillespie; secretary-treasurer, Geo. Hogarth; executive committee, J. R. W. Ambrose, Willis Chipman, E. L. Cousins, Prof. Haultain, E. G. Hewson and R. O. Wynne-Roberts. The retiring chairman, E. W. Oliver, also acts as a member of the executive.

MANITOBA

ELEVEN regular meetings of the branch were held, at which the following papers were read and discussed: January 4, "Scientific and Industrial Research," E. Brydone-Jack; February 2, "A View of Necessary Action for After-the-War Conditions," T. R. Deacon; March 1, "Methods Adopted in the Construction and Ventilation of Connaught Tunnel," J. G. Sullivan; April 5, "Contracts 32, 33 and 34 of the Winnipeg Aqueduct," Wm. Smaill; May 3, "Subsurface Formation of the Winnipeg District and Types of Suitable and Unsuitable Foundations for Its Heavy Buildings," J. G. Rankin; October 4, "Drainage in the Red River Valley in Manitoba," G. B. McColl; October 18, "A Civic Duty for Engineers," F. A. Cambridge; November 1, "The Fixation of Atmospheric Nitrogen," V. J. Melsted; November 19, "Some Elements of Economy in Air Compressors," Wm. Carter; December 6, "Munitions," J. Chalmers; December 18, "Lignite Coal as Applied to Modern Steam Plants," T. L. Roberts. The average attendance at these meetings was 27.

Meetings were also held by the Electrical Section during the first part of the year (1917) as follows: January 10, "Train Lighting System," A. C. Turtle; February 14, "Progress in the Electrification of Steam Railways," W. A. Duff; March 21, "The Mercury Arc at Constant

Pressure," J. W. Dorsey; April 11, "Electric Furnaces," A. M. Tirbutt; May 9, "Automatic Printing Telegraph," H. McConkey.

At the beginning of the season 1917-18 it was decided to discontinue the activities of the Electrical Section for the present and to hold two meetings of the branch each month, the second monthly meeting to be held on the third Monday of the month.

In addition to the regular meetings, members of the branch were the guests of the Greater Winnipeg Water District on July 21st in an excursion over the work on the aqueduct.

On September 13th a motion picture exhibit of water powers throughout Canada, prepared by the Dominion Water Power Branch of the Department of the Interior and loaned to the society, was held under the auspices of the Manitoba Branch in Kelvin Technical School.

On September 20th, members were the guests of the Canada Lock Joint Pipe Co. in an inspection of the work being done by that company, at Transcona, for the Greater Winnipeg Water District. Luncheon was provided by the company at Transcona and a special train was furnished by the Water District for the trip.

The branch had the pleasure, on August 15th and 16th, of entertaining our new secretary on his first official visit to the branches. Mr. Keith met many members at luncheon on the 15th and later visited points of engineering interest in the city and vicinity.

This first visit of the secretary was much appreciated and a unanimous resolution was forwarded to the council recommending that the visit of the secretary to the branches be made an annual event.

Four applications for admission as local associates were favorably passed by the executive. The membership of the branch now includes 37 members, 85 associate members, 26 juniors, 22 students, and 43 local associates, total 202.

Fifty-nine members of the branch have enlisted for active military service. Four have been killed in action or died of wounds.

The death, on February 6th, of W. L. MacKenzie, chairman-elect and one of the oldest and most valued members, was a great loss to the branch.

W. A. Duff was elected chairman to fill the vacancy caused by the death of W. L. MacKenzie.

The annual meeting of the branch was held December 6th, 1917, and the following officers were elected for the season 1918-19: Chairman, W. A. Duff; secretary-treasurer, G. L. Guy; executive committee, W. P. Brerton, J. C. Holden, W. M. Scott; auditors, B. S. McKenzie, T. L. Roberts.

The treasurer's report presented at the annual meeting of the branch showed a credit balance of \$742.94.

SASKATCHEWAN

THIS is the first annual report of the Saskatchewan Branch, Canadian Society of Civil Engineers, a continuation of the Regina Branch which was founded in January, 1915, and which concluded its first year with 25 members. Our last annual report (as Regina Branch) dated January 19th, 1917, shows a membership of 30, of which 11 were on active service, while we are able at present to report a membership of 75 (with 14 overseas members).

It is very gratifying to state that of this increase in membership fifteen are new members of our society, while

there are still seven applications from our province pending to be dealt with by the council of the parent society, so that the outlook for the ensuing year in this connection is also very promising.

After considerable correspondence with engineers in this province and a number of organizing meetings, it was decided to enlarge the scope of our former Regina Branch and change the name to Saskatchewan Branch. Owing to a misunderstanding of our aims, the permission of the council of our parent society was withheld for some time. After same was obtained, the first regular meeting of the Saskatchewan Branch was held on May 10th.

There have been 9 regular meetings, 1 emergency meeting and 8 executive meetings, also an excursion to Fort Qu'Appelle to inspect the Sanitorium for Tuberculosis while under construction.

Some of the papers presented to the branch were as follows:—

"Some Aspects of Indian Engineering," E. G. W. Montgomery; "Drainage Problems in Saskatchewan," C. S. Cameron; "A Few Reminiscences of the Gallipoli Campaign," Capt. V. Michie; "Sewage Disposal," W. H. Greene; "The Sanitorium at Ft. Qu'Appelle," E. A. Markham.

The formation of our provincial library is well under way and a number of valuable donations have already been received.

The Regina Engineering Society decided during the year to discontinue its activities, wherefore the arrangement of joint alternate meetings was cancelled.

The executive council of the government of the province was petitioned, the advice and support of our members being pledged in all important questions.

At our annual meeting on January 10th, the following officers were elected for the ensuing year:—

Chairman, G. D. Mackie; vice-chairman, H. S. Carpenter; secretary-treasurer, J. N. de Stein; executive council, H. R. MacKenzie, E. G. W. Montgomery, W. H. Greene, C. J. Yorath and J. E. Underwood

CALGARY

DURING the past year there have been six general meetings of the branch, including the annual meeting in December last. The executive committee has held twelve business meetings. During the year the branch has been entertained by the following speakers:—

December 19, 1916—Capt. H. Sidenius, "Military Engineering and Trench Warfare in the European War."

January 18, 1917—C. W. Craig and J. F. Greene, "The Centre Street Bridge, Calgary."

February 15—W. A. Lamb, "The Water Resources of the State of Montana."

March 26—James White, "The Work of the Conservation Commission."

April 25—Col. J. S. Dennis, "The Part the Canadian Society of Civil Engineers is Taking in the War."

August 20—Fraser S. Keith, "Co-operation Between Branches and the Parent Society."

On the occasion of President Dennis' visit a dinner was given at the Palliser Hotel, which was attended by a number of ladies. The Roll of Honor of the Calgary Branch was unveiled by President Dennis on that occasion. The Roll of Honor was afterwards placed in the Calgary Public Library, where it is now on view.

At the annual convention of the Western Canada Irrigation Association at Maple Creek in August, our branch

was represented by William Pearce and J. S. Tempest. The parent society was represented by the following members of our branch: F. H. Peters, S. G. Porter, C. M. Arnold and M. H. French, and by R. J. Burley of the Ottawa Branch.

A number of our members, under the chairmanship of P. M. Sauder, have co-operated with the Research Council in the distribution of questionnaires, and in other matters pertaining to the work of the council.

The secretary of the Calgary Branch has acted as secretary of the provisional organization of the Alberta Division of the society. By-laws have now been approved, and it is expected that the first regular election of officers will be held this winter.

During the year we have perfected arrangements with the Calgary Board of Trade whereby an Engineering Section of the Board of Trade has been organized, which will deal particularly with the engineering phases of public questions which come before the board. The members of our branch who are also members of the Board of Trade, constitute the Engineering Section. They will have the privilege and will be expected in matters involving the general or local welfare of the engineering profession, or in matters in which the views or influence of the branch as an organization will be helpful, to refer them to the branch for consideration. It is expected that the relation which we have established with the Board of Trade will be of means of bringing our branch into closer touch with business and public interests and increase our usefulness to the community.

The executive committee has also taken the initiative in a movement to secure Dominion legislation defining the status of the engineer and giving adequate protection to the profession and to the public.

The annual meeting was held December 1, 1917, and the following officers were elected for the ensuing year:—

Chairman, Wm. Pearce; secretary-treasurer, C. M. Arnold; executive committee, A. S. Dawson, F. H. Peters, S. G. Porter, H. Sidenius and A. S. Chapman; auditors, W. J. Gale and J. S. Tempest.

The present membership of the branch is sixty-six.

EDMONTON

THE branch membership includes 56, of whom 21 are on active service.

The Alberta Provincial Division held the first annual meeting in Calgary on December 22nd.

Fraser S. Keith, secretary of the society, paid the branch an official visit for the purpose of getting personally acquainted with the branch membership and discussing society affairs. We think that this policy is productive of good results in co-ordinating the general membership of the society.

The status of engineers in Canada was the basis of considerable discussion. The branch membership is strongly of the opinion that this question merits the attention of the whole society.

The following papers were read before the branch:—

March 21st, "The Centre Street Bridge, Calgary," by Geo. W. Craig; May 11th, "Shell Manufacture," by J. Chalmers, supervisor of production, Imperial Munitions Board, Winnipeg.

The officers of the branch are as follows: Chairman, L. B. Elliot; vice-chairman, J. D. Robertson; secretary-treasurer, A. W. Hadow; executive, D. J. Carter, J. L. Cote, D. Donaldson and A. T. Fraser.

VICTORIA

THIRTEEN meetings were held during the year, with an average attendance of 10, and the following papers were read before the branch:—

February 7th, "Manufacture of Steel," R. R. Neild;
April 11th, "Engineering Work in Seattle." A. H. Dimock; May 16th, "Sooke Water Supply System," C. H. Rust.

On February 26th a representative committee of the branch interviewed the newly elected provincial government premier and his cabinet ministers, placing clearly before them the national character, standing and aims of our society. An attentive hearing was given and many questions asked, the trend of which indicates that there is a great deal of educational work to be done by our members in Canada before the Canadian Society of Civil Engineers will be known and recognized by the public as one of the greatest assets in the development and progress of the Dominion.

At the commencement of 1914 our membership roll stood at 80, and since the outbreak of the war 33 have gone overseas on active service, where the "Last Post" has sounded over three. A fourth is held prisoner in Germany. At present the branch has 40 per cent. of its members with the allied armies, and we enter the new year with a membership of 74.

The annual meeting was held December 12th, the following officers being elected:—

Chairman, R. W. Macintyre; vice-chairman, R. Fowler; treasurer, E. Davis; secretary, E. G. Marriott; executive, the officers and W. K. Gwyer and E. P. McKie; auditors, C. Hoard and F. C. Green.

VANCOUVER

THE officers of the branch are as follows: Chairman, W. E. E. Carey; vice-chairman, E. G. Matheson; secretary-treasurer, F. P. Wilson; acting secretary-treasurer, A. G. Dagill; executive committee, C. Brakenridge, C. E. Cooper, H. M. Burwell and A. E. B. Hill.

ALBERTA DIVISION

AT the annual meeting in January, 1917, we reported a preliminary organization of the Alberta Division. On December 22nd, 1917, the division held its first regular annual business meeting, at which by-laws were adopted, officers elected, and other business transacted. The officers are as follows:—

Chairman, William Pearce; secretary-treasurer, Sam. G. Porter; executive committee, F. H. Peters, S. G. Porter, L. B. Elliott, A. T. Fraser, J. T. Child and J. G. McGregor.

BRITISH COLUMBIA DIVISION

NO formal meetings have been held, no funds have been received and no financial expenditures incurred. The Division is in a state of suspended animation.

It is felt that while there may possibly be a need for a provincial division in normal times, there is abundant excuse for the fact that no desire is manifested on the part of any of the members to divert any energy during these unprecedented days to the duplication of the work of the branches. The organization of the division will still be maintained.

ONTARIO HYDRO BUYS EQUIPMENT

At a recent meeting of the board of directors of the Ontario Power Company, of which Sir Adam Beck is President, the board approved of the arrangements made by Sir Adam with the Bank of Montreal for an advance of \$1,250,000 required to construct the additional pipe line and two extra generating units at the company's plant at Niagara Falls. The cost of the work will be \$1,800,000, the additional \$550,000 being taken from the surplus derived from the company's operation. Sir Adam says that the bank loan will be repaid after two years of operation.

The contract for the two generators was awarded to the Canadian General Electric Company, while two S. Morgan Smith Company turbines were purchased from the Tallahassee Power Company, of South Carolina. The contract for the construction of the wood-stave pipe line, 13½ feet in diameter, was awarded to the Pacific Coast Pipe Company. The new generators will each have a capacity of 18,000 h.p.

At a meeting of representatives of the Hydro municipalities last week, Sir Adam stated his belief that the Commission would be able to complete the construction of the Chippewa Canal a year before the limit fixed before the war, as labor had been eliminated to a large extent by the use of heavy equipment. Six hundred men are employed on the work at present. Orders to the extent of

\$4,000,000 have been placed on the Chippewa development, but the money has not yet been forthcoming with which to pay for all of the equipment ordered.

"If 300,000 h.p. could be made available a year before we were counting on it, that would be of enormous value both to Canada and the United States," said Sir Adam, "as we are now allies fighting for the same cause and we should co-operate in the manufacture of war supplies and munitions."

The following resolution urging the Power Controller to commandeer the plants of the Canadian Niagara Power Co. and of the Electrical Development Co., was passed by the meeting upon motion of P. B. Yates, of St. Catharines:—

"That this meeting of the representatives of the Hydro municipalities demands of the Power Controller the operation of all generating plants by representatives of the Power Controller in order to secure an equitable division of all available power to the distributing systems affected, and that we urge instant action to relieve the present intolerable situation; and that we have reason to believe that there are some thousands of horse-power of electrical energy available which can be utilized over the lines of the Hydro-Electric Power Commission of Ontario, and that you order such power to be placed on these wires for distribution without delay."

Canadian Society of Civil Engineers

Report of Thirty-Second Annual Meeting Held Last Week in Montreal—Society Votes to Change Its Name—New Bylaws Adopted—Ceremony of Unveiling the Honor Roll—Fuel Situation Discussed

TO commemorate one way in which members of the Canadian Society of Civil Engineers have helped to win the war, an honor roll bearing 862 names was unveiled at the thirty-second annual meeting of the society, held last week in Montreal.

Realizing that nothing can be done by the engineers at home which will in any way compare with the sacrifices made by those 862 heroes, the members who attended the annual meeting felt reluctant to indulge in much discussion of the minor affairs of the society. Most of the sessions, therefore, were routine and perfunctory, with little interest taken in the work, and with but few new ideas of value introduced. One notable exception to this was in connection with the paper on "Fuels," read by B. F. Haanel. There the engineers saw a chance to accomplish some real work of value to the country, both in winning the war and in recovering from its effects, and they plunged into the discussion with vim and an evident desire to be of economic usefulness.

The scrutineers reported to the meeting that 440 ballots had been received on the new by-laws and 599 on the change of name, and that both propositions had carried by large majorities. The new by-laws go into effect at once, but the change of the society's name cannot be finally accomplished until Parliament consents to the necessary change in the charter. The new name is "The Engineering Institute of Canada."

The attendance at the meeting was smaller than that at several previous annual meetings. Only 153 were registered, of which 98 were from Montreal or suburbs, 14 from the Province of Quebec outside of Montreal, 19 from Ottawa, 7 from Toronto, 10 from Ontario other than Ottawa and Toronto, 3 from the Maritime Provinces and 2 from Winnipeg.

As previously announced, the president for the next twelve months will be H. H. Vaughan, of Montreal. The new vice-presidents are Prof. H. E. T. Haultain, of Toronto, and R. F. Hayward, of Vancouver. The new members of council are Prof. E. Brown, J. M. Robertson, Donald H. McDougall, Noel E. Brooks, John Murphy, Prof. Peter Gillespie, L. A. Thornton and Prof. E. G. Matheson.

Monday Morning Session

Only thirty members were present when Col. C. N. Monsarrat called the meeting to order at 10.10 a.m., Monday, January 21st, but this number was increased to fifty before the morning session was adjourned. Col. J. S. Dennis, the president, was unable to be present, so Col. Monsarrat, one of the vice-presidents, took the chair. F. S. Keith, the society's new secretary, read the minutes of the last meeting as recorded by the late Prof. C. H. McLeod. Upon motion of J. M. R. Fairbairn, seconded by Walter J. Francis, the following council resolution was unanimously adopted:—

"That this council record in the minutes of the society the sense of its great loss by the death of Professor Clement Henry McLeod, who for twenty-five years was the secretary of the society and a member of this council, and whose death removed from our midst one who was intimately associated with the welfare of the society since

its inception, who was personally interested for forty years in the engineering education of a great number of young Canadians, and who had ever before him the best interests of the engineering profession in Canada. This council further desires to express its sincere sympathy to Mrs. McLeod and her family in their bereavement."

Letter from Col. Dennis

The following letter from Col. Dennis was read by Col. Monsarrat:—

"I am asking the chairman at the opening of the annual convention of our society to read this statement as an explanation to the members of my failure, as president, to be with you and preside at the annual meeting.

"For something over six months, at the request of the Canadian Government and as second in command of the British-Canadian Recruiting Mission in the United States, I have been devoting all my energies to the matter of endeavoring to secure recruits in the United States for our army. Our efforts have been met with a fair measure of success, as will be indicated by the fact that up to date we have sent to Canada something over 16,000 men.

"These duties have been such that it has been impossible for me during that period, as your president, to fulfil any part of my duties in connection with the society's affairs. In the early part of the year I tried to do what I could to assist in the reorganization of the society, so that its affairs might be put in a good condition, and I hope that you will be satisfied with the work then initiated, and which, during the latter half of the year, has been carried out so loyally by the members of the council, with the assistance of our able secretary, with the desired effect of rehabilitating the affairs of our society and putting them in good standing.

"My personal thanks are due to the vice-presidents, secretary and the members of council for the loyal way in which they have carried on the work without any assistance from me, and, while it was my hope during the year that when the annual meeting was held I would have been able to preside and feel that you appreciated the efforts made during the year, I hope that those in attendance will realize that only the importance of the duties that I am performing here has denied me that pleasure, and will feel that, as your president, the work that I have been able to accomplish in the United States has added one more evidence, if any were needed, that the members of the engineering profession attached to our society have been doing their bit to help Canada in our great struggle.

"I especially regret that I will not be present at the unveiling of our Roll of Honor of our members who are serving at the front. I feel that that Roll can, for all time, be pointed to as an evidence of the fact that the Canadian Society of Civil Engineers has responded nobly to the great Cause, and has proved, if any proof were needed, that the members of the engineering profession are always found in the front rank when duty calls.

"I trust that the annual meeting will be eminently successful in every way, and I extend to the members my sincere thanks for the great honor done me in allowing

me to occupy the position of your president during the past year, and assure the incoming president and members of council that I stand ready during the coming year or at any time to give them and the society every possible assistance in my power to continue the good work which has been begun to put our society in the position it is justified in occupying in Canada."

Reports of Standing Committees

R. A. Ross presented the report of the finance committee. He thought that the statement was creditable in view of the fact that \$20,000 fees had been remitted during the past three years on account of members at the front. He estimated the value of arrears at \$5,000, and said that each year, for several years past, \$6,000 had been collected on this item. Probably another \$6,000 could be collected this year, but then the remainder would have to be charged off the books, and this item would no longer be a source of revenue. Many names will have to be struck off the membership this year for non-payment of dues. Probably 250 men, getting the transactions and papers, are merely an expense to the society and should be cut off the list.

In discussing the report of the library and house committee, Walter J. Francis moved that the index of books in the library be prepared and distributed without delay, as recommended by the committee. The meeting felt that it would be better to leave the matter to the council, as the cost must be considered.

Branch Reports

The branch reports, which appear upon another page of this issue, were all read by the secretary with the exception of the Toronto report, which was read by George Hogarth, and the Ottawa report, read by J. B. Challies. R. A. Ross expressed the sentiment of the meeting in saying that great credit is due the Manitoba members for the good work they are doing as evidenced in their splendid report.

J. B. Challies suggested that each branch make a report to the annual meeting, showing what it has done with its finances. Some branches spend money in ways in which other branches do not, and the society in general should receive an annual balance sheet from each branch. The Manitoba branch, for instance, is publishing its own proceedings. The Ottawa branch has a substantial surplus, but never felt the necessity of publishing separate proceedings.

Sir John Kennedy and H. R. Safford supported this suggestion, but A. D. Swan enquired whether the parent society is responsible for the debts of the branches. If so, full statements should be submitted by the branches. If not, it is the branches' own business what they did with their finances. A suggestion was made that all branches be asked not to publish any separate transactions at the present time. It was moved and carried that each branch should hereafter submit a financial statement with its annual report.

Continuing this discussion at another session of the annual meeting, H. R. Safford introduced a resolution, asking the branches to discontinue publication of separate transactions pending the formulation of a definite policy by the society regarding inclusion of branch papers in the society's main transactions.

R. F. Uniacke asked whether this resolution would prevent the publication of branch papers in *The Canadian Engineer*. He said that very many branch papers had received early publicity through that channel, and he

thought it was of value, and desirable that nothing be done to interfere with such publication. Mr. Safford replied that his resolution was not aimed at all at journalistic publication of branch papers, but was intended only to restrain the branches from spending the branch funds in publishing the papers in pamphlet form.

Walter J. Francis said that if the new by-laws were carried, Montreal would only be a branch and all branches would be on the same plane of equality, and that the transactions would then include the best papers from coast to coast, wherever read, and he thought that the problem would thus soon solve itself, and that all branches would see that separate branch transactions were unnecessary. Mr. Safford said that in that case no doubt the branch transactions would soon be automatically dropped by the branches themselves, anyway, and he, therefore, withdrew his resolution.

All Committees Dismissed

M. J. Butler, C.M.G., introduced the following resolution:—

"That it is the opinion of the meeting that the subject of special committees be reconsidered by the council, and that hereafter the appointment of such committees be limited to such subjects as define the quality of the materials rather than having the wide scope hitherto permitted to such committees."

The scope of committee activities should be limited, said Mr. Butler. Committees should not deal with the methods of using materials or with design or construction, but only with the materials themselves.

Sir John Kennedy spoke in favor of the motion. The society, he thought, was getting on dangerous ground in introducing specifications that were educational in character. It was not necessary to issue specifications to be used as text books by county councils, etc. The work of the engineering profession should be guarded in this connection. "The American and British societies of civil engineers are not doing it, but the Canadian society is going ahead, writing specifications on its own hook, without regard to any international standards," said Sir John.

Walter J. Francis saw no necessity for the society to write such a complete specification as to give the world at large the result of the best engineering investigation, and so clearly that almost anyone could follow the specifications and dispense with engineering services.

A. D. Swan also supported the resolution upon the basis of lack of standardization with British specifications.

H. H. Vaughan took issue with the previous speakers. He referred to the valuable work being done by the American Society for Testing Materials, and said that engineers disagree regarding both materials and their uses, and he saw no reason for making a secret of how materials should best be handled any more than of what standards of quality should be obtained in materials. The more publicity that is given to good methods of doing work, the better, he said. Take, for instance, the boiler code. How could a good boiler code be prepared without stating how the boilers were to be put together, how the seams were to be made, etc.? Those are the points on which publicity is needed. "Probably more boiler explosions are caused by faulty seams than from any other one reason," said Mr. Vaughan. "There may be a 'nigger in the fence' in this resolution. Perhaps it is aimed at the steel highway bridge specifications, which possibly should receive consideration before being

adopted, but I can see no reason for Mr. Butler's resolution."

R. A. Ross urged that all the existing committees be dismissed for the time being, subject to reappointment by council. The by-laws are being radically changed, the society is broadening out, and the council should have a free hand in appointing committees. There should be standards, but when applied to structures instead of materials, where was the society going to stop? Some committees are redundant and might be discontinued.

M. J. Butler said that standard specifications should prevail throughout the whole allied world. Societies here should work in co-ordination with British standard committees. Replying to Mr. Vaughan, he agreed that the American Society for Testing Materials is doing work of the utmost value to all engineers, and he said that is all the more reason why we should abandon our own committees, and, instead, accept the work of such standard committees. The only work for which specifications have been absolutely standardized is aeronautics. In building aeroplanes, the same words mean the same thing throughout all the allied countries.

The meeting voted in favor of Mr. Butler's resolution, and decided to discontinue all committees, subject to council's reappointing or reconstituting any that it might deem desirable.

Report of Conservation Committee

James White, deputy chairman of the Commission of Conservation, Ottawa, presented the report of the conservation committee, of which he is chairman. He said, in part:—

"Stimulated by the war and conditions created thereby, Canadians are to-day recognizing in greater measure than hitherto, that our resources are not as we so frequently designate them—'illimitable' or 'inexhaustible.' On the contrary, our wastefulness, our carelessness and our inefficient methods have, in some instances, made such inroads upon them that all but the ignorant and unobserving can see that nothing but the practice of economic and efficient methods will permit us to hand down to our posterity an inheritance that will suffice for their needs.

"One of the outstanding achievements of the year is the elimination of the curse of patronage in the matter of appointments by the Dominion government.

"The development of hydro-electric power in Ontario has been phenomenal. At present, the Hydro is delivering 296,000 h.p. and still is short 70,000 h.p. There is also a shortage of power in Eastern Ontario, although upwards of 60,000 h.p. is being exported from the Cedars Rapids plant to Northern New York State. The Cedars power is used by the Aluminium Co. of America in their Massena plant and by municipalities in the vicinity of Massena.

"Eight years ago the Commission of Conservation actively opposed the granting to private interests of the privilege of developing power at the Long Sault Rapids of the St. Lawrence. Recently the Commission has also opposed an application by private interests for permission to develop the Coteau Rapids power.

"In his annual address to the Commission of Conservation, November 27th, 1917, Sir Clifford Sifton referred to the Niagara Falls situation where we are exporting 125,000 h.p. and are unable to take it away from the manufacturing and other interests in the United States. He also advocated the development of the international water powers of the St. Lawrence 'by an international commission, under which the greatest and best use of the

powers will be made, the most economical development will be effected, a just and equitable division of the power will take place and the governments concerned will be able to administer the power as the Ontario Hydro-Electric Commission administers the power of Niagara for the benefit of the people who are directly concerned in its use.'

"This pronouncement will appeal to the engineers of Canada as a progressive, a constructive and a statesman-like policy.

"Sir Clifford also voiced a sentiment that will doubtless receive full assent and hearty approval from the members of our society. He said:

"We are still largely dominated in Canada by the idea that any ordinary capable amateur can do the work which ought to be done by a trained scientific man, and, until we eradicate this fallacy thoroughly, and, in its place, implant the view that men who are technically trained are the only men competent to deal with technical problems, we shall not begin to attain to general success in making the best use of the materials which are at our disposal.'

"In connection with the development of the water power of the rapids of the St. Lawrence an estimate of the power available is of interest. A. V. White, consulting engineer to the Commission of Conservation, estimates that the total maximum low-water, 24-hour horse-power is 2,395,000, and the average 24-hour, low-water horse-power is 2,150,000. Assuming an equal division of international powers, 1,955,000 h.p. of the maximum low-water power belongs to Canada and 440,000 to the United States.

"If we use the experience of the Ontario Hydro as a basis, we get a diversity factor of 30 per cent., which increases Canada's resources to the equivalent of 2,541,500 h.p. for maximum low-water power.

"The great conservation dam at La Loutre on the St. Maurice River is approaching completion. It will impound the third largest artificial reservoir in the world, being exceeded only by the Asuan dam on the Nile and Gatun Lake on the Panama Canal. The St. Francis River dam at the outlet of Lake St. Francis is also, nearing completion. The low-water flow of the St. Maurice will be doubled and the minimum potential horse-power will be increased by 550,000 h.p."

Mr. White reviewed successively the present conditions of Canada's forests, lands, minerals, fisheries and game, and also discussed the fire waste problem. "The United States is thoroughly scared over its declining pulpwood supply," he said. "We are so ignorant of our own supplies that we do not now whether to be scared or not."

Mr. White said that the white pine blister rust threatens with total destruction the most valuable forest tree in Canada. Our white pine has been valued at \$200,000,000. The fungus lives alternately on the pine and on currant or gooseberry, wild or cultivated. If either be wanting, it cannot exist. It is a question, therefore, which is the more valuable and whether we should eradicate currant and gooseberry growths in order to save the pine.

"An example of wasteful methods is the coking of coal," said Mr. White. "At present there are in Canada approximately 1,700 beehive ovens with an annual production of 443,460 tons and 910 by-product ovens with a production of 1,005,322 tons. The beehive ovens waste all the valuable by-products.

"E. T. P. Shewen suggests the importance of commencing on an adequate scale the distillation of domestic coal, to recover the by-products, using the coke as domestic and other fuel.

"C. R. Coutlee suggests the handing over to the Federal government of provincial interests on rivers of 20,000-square-mile drainage areas and of sufficient flow, with a view to ideal development of power at public expense."

Mr. White also presented a long but most interesting report by C. E. W. Dodwell, covering a wide range of important conservation topics, including denatured alcohol, fuels and natural resources, and this report will be printed by the society as a part of the conservation committee's report. Mr. Dodwell lays especial stress on the statement made last year by Mr. Shewen that "in exporting raw material, a country derives from its natural products the least advantage."

Col. R. W. Leonard commented upon the general review of the Conservation Committee as follows:—

"The remarks on the devising of fire places and furnaces which would render coke as satisfactory as coal for domestic use, recall to my mind that most of last winter I burned coke in my house furnaces with excellent satisfaction, it being quite as good as anthracite coal, but because it burned more freely, the draughts had to be regulated a little closer and the fire required more frequent attention in cold weather.

"The other remark on the conservation of the use of coal by extracting the by-products first and burning the coke for domestic use afterwards is, I consider, eminently practicable, and I see great possibilities in large centres of population by importing bituminous coal, coking it in by-product ovens, using the gas directly for heating, lighting and generating electric power, saving the tarry and ammonia by-products and using the coke for industrial and domestic purposes.

"Such an industry would require a very large expenditure of capital, and if this capital is to be subscribed by private investors, great care must be taken to regain the confidence of the investing public in the permanence and success of public utilities and the prospect of favorable returns on their investment."

Mr. White announced that W. F. Tye, a past-president of the society, had just been elected a member of the Commission of Conservation, to succeed the late Sir Sandford Fleming as the society's representative on the commission. Mr. White also announced his own resignation from the council of the society, stating that he intended to place same in the hands of council at a very early date. He had consented to be a candidate for election to council just for the purpose of obtaining certain reorganization that had now been effected, and he had intended to remain on council only for six months. Subsequently, he had been urged to continue, and had done so for another six months, but now that he had served twelve months on council, he intended to resign, owing to certain conditions which he had met within council, and which prevented him from doing his best work while on that body.

J. B. Challies said that he was a member of the committee of conservation, and that the committee never had a meeting, so that to Mr. White must go the credit of the whole report. Mr. White had given him an opportunity of reading his report, however, shortly before the annual meeting of the society, and certain changes in the report had been suggested, all of which Mr. White had subsequently made. The Ottawa managing committee did not know that Mr. White had intended to resign from council, and he was sorry that Mr. White had decided to do so, as Mr. White had been of much help to the managing committee of the Ottawa branch.

Adjournment was then moved, at 1 p.m., the discussion on the report of the conservation committee to continue at 3 p.m.

When the meeting was called to order for the afternoon session, James White moved that the members should signify to council their desire to continue a conservation committee, in view of Mr. Butler's motion disbanding all committees. After considerable discussion regarding the propriety of such a motion, which some thought might tend to tie council's hands and nullify Mr. Butler's motion, the resolution, as submitted by Mr. White, was passed with only one dissenting vote. Upon amendment by Mr. Challies, a rider was attached to the resolution, stating that the committee's functions were to be defined by council.

Col. Leonard Makes Interesting Announcement

Referring to conservation work, Col. R. W. Leonard made an interesting announcement regarding experiments on the Sudbury nickel dumps. These experiments were carried out at the Montreal East steel plant of the Canada Cement Co., where it was found that a high-grade alloy steel, containing copper and nickel, could be manufactured from the large resources available to Canada in the Sudbury dumps. No nickel steel is being manufactured in this country at present, said Col. Leonard, and the Sudbury dumps should be treated while the present high prices prevail. The roasted ore had been reduced to pig in electric furnaces. The objections to copper in steel were found to be based on prejudice and not on fact. By request of the meeting, Col. Leonard agreed to have the engineer in charge of the experiments write a report about the process, to be included in the printed proceedings of the society.

Roads and Pavements Report

In the absence of W. A. McLean, the chairman of the roads and pavements committee, the secretary read the following report.—

"Following the formation of the committee in 1915, the opinion of the members was sought with a view to deciding on what lines information was most generally required. It appears that a survey of the methods and costs of pavements of various types would result in the securing of valuable data, and that, in addition, there was a need for reliable specifications for the materials used in road and pavement construction.

"Your committee, therefore, proceeded to work on two definite lines: First, the collection of information concerning the construction of pavements with a view to correlating it with information received at later dates, indicating the success or failure of different methods of construction; and secondly, the compilation of specifications for road-building materials.

"In the report of the committee, presented at the last annual meeting to the society, a list of the pavements concerning which information had been received was given, specifications for crushed stone, gravel and sand were presented for adoption by the society; and a progress report on specifications for asphaltic road oils, with tentative specifications; were included

"The specifications for crushed stone and gravel have been used by members of the committee and others, and up to the present no suggestions for improvement have been received. As there was a lack of uniformity between the specifications for concrete sand issued by the committee on concrete and reinforced concrete and those issued by this committee, it was suggested that the two committees consider the matter together with a view to

obtaining a uniform sand specification. While steps in this direction have been taken, insufficient progress has been made to enable the committee to offer a revised specification. It is anticipated that during the coming year a satisfactory specification for concrete sand will be evolved.

"Progress is being made in the preparation of further specifications for materials, but they are not sufficiently advanced to submit to the society. The attention of the society should be drawn to the fact that those submitted in the last annual report of this committee were of the nature of a progress report only, and were not put forward for use by the membership, but for discussion only.

"Progress has been made with regard to the collecting of information concerning the construction of pavements. During the early part of the year blank forms were sent to the engineers of sixty of the cities and large towns of the Dominion with a request that pavements constructed under their supervision be reported on. The number of reports received, including those summarized in the last annual report of the committee, makes a total of 122 pavements, which number will be increased considerably before the end of the year. This means that your committee has under observation, through the co-operation of the municipal engineers throughout the Dominion, the aforementioned number of pavements."

Walter J. Francis moved that the meeting receive the report and recommend to council that the committee be continued. Sir John Kennedy enquired whether the committee was not getting perilously near teaching municipalities how to build roads. He thought the tendency dangerous if carried too far.

Electro-Technical Commission

Secretary Keith read the following report of the Electro-Technical Commission:—

"The committee begs to report that during 1917, as in the two years previous, the commission's activities have, of course, been considerably curtailed, though the central office in London has done all that was possible under the circumstances to keep the organization together and to forward the work.

"To this end, and because of the importance of the subject, a conference on the rating of electrical machinery was held in London in September, the meetings being attended by delegates from the British and United States committees, and by A. P. Trotter, consulting engineer, of London, who very kindly accepted our chairman's invitation to represent the Canadian committee.

"When the work of this conference is finished, and all details settled, another great step will have been made towards world-wide electrical standardization, with all its attendant advantages. For instance, to mention just one, all tenders, whether from manufacturers of the same or different nationalities, will then be comparable on a uniform basis as to performance claims, guarantees, etc.—a condition that has not always obtained in the past, although obviously most desirable."

Walter J. Francis moved that the report be received and the committee continued. Carried.

Steel Highway Bridge Specifications

P. B. Motley, chairman of the committee on steel bridge specifications, presented the following report:—

"I beg herewith to transmit a specification for steel highway bridges, including movable bridges, as recommended by your committee on steel bridge specifications.

"This committee has had eight general meetings, as well as numerous sub-committee meetings, during the year, attended by most of the Montreal members, and the results of the meetings have been communicated to the branch members for their information and remarks.

"After considering all discussions sent in, draft specifications for highway bridges have been respectfully submitted to the society. The committee has also given some attention to the existing specification for fixed steel bridges, and is of the opinion that it be corrected and revised as regards sequence, etc., generally in accordance with the highway bridge specification now presented. It was, however, found impossible to deal with the matter during this season.

"The specifications resulting from the work of this committee are intended to be recommended practice for use of public bodies, such as the federal and provincial governments, commissions and municipalities. They are not intended to take the place of a duly qualified consulting engineer, but to form a basis for specifications drawn up to meet the requirements of the case in hand.

"It was thought by some members of the committee that it would be proper to recommend a series of suitable loadings for given widths and classes of highways. These are put in the form of a short preamble, and are capable of variation and interchange by the user.

"A schedule of information to be provided bidders is also attached.

"It is recognized that there are a number of clauses that are open to discussion, such as impact, unit stresses, column formula, lattice bars, etc. All these controversial points have received careful attention, and, while they are still in a more or less inconclusive stage, it is thought that the specification represents the best and most recent practice, and it is hoped that public bodies will be inclined to use it as extensively as possible, so that uniformity, and, therefore, economy may be secured in the bridge construction of this country.

"While the earlier drafts of the report have been sent to the branch members of the committee, it has been impossible to send them the final draft, because the work of revision has continued to the present time.

"As the work of the committee is continuous in its nature, it is recommended that it be continued to include the revision of the present railway fixed bridge specification and reinforced concrete bridges."

R. F. Uniacke said that the Ottawa branch thought that the specification was not so full as that in use by the Ontario Department of Highways and the Ontario Railway and Municipal Board, but that as the specification had already been printed, he moved that it be received.

W. Chase Thomson said there are some errors in the tables which should be corrected before the final specification is printed. Mr. Motley replied that there are no typographical errors, but that possibly the arrangement of some of the tables could be altered so as to make them clearer.

Prof. Mackay said that there are some formulæ and requirements in the specification which might be criticized, but that, as the specification is still tentative and in draft state, that there was no need to take up the time of the meeting by discussing these technical points, as no doubt the committee would gladly give earnest consideration to all suggestions anyone might make tending toward the improvement of the specification, and that these suggestions could be brought before the committee from time to time during the coming year.

Education and Board of Examiners

Prof. H. M. Mackay, chairman of the committee on education and of the board of examiners, presented the following report:—

“Since the fusion of the committee on education with the board of examiners, regular meetings have been held monthly, or more frequently when occasion demanded, in convenient relation to the meetings of council. In this way it has been possible to consider applications for admission or transfer with the least possible delay. In addition, a considerable number of applications held over from previous years have been dealt with, and the work of the committee has been brought quite up to date.

“Examinations for candidates seeking admission or transfer were held in July and November as follows:—

Subject.	Candidates.	Passed.
“Theory and Practice of Engineering ..	4	2
“Railway Engineering	3	3
“Hydraulic Engineering	2	2
—	—	—
“Total	9	7

“The work of the committee would be greatly facilitated, and it is believed the standards of the society would be improved, if branches and members generally would urge upon candidates, whose educational attainments are not strictly in accordance with the by-laws, the desirability of preparing and presenting themselves for these examinations.”

Concrete and Reinforced Concrete

Walter J. Francis, chairman of the committee on concrete and reinforced concrete, presented the following report:—

“Your committee has held no formal meetings during the year, but the individual members have given considerable attention to the question of revising the present standard specifications. They have also studied the final report of the joint committee on concrete and reinforced concrete, in which members of the American Society of Civil Engineers took part.

“In view of the fact that no complaints or adverse criticisms of the existing standard specification for concrete and reinforced concrete have reached the committee, that a number of the members know the standard specification to be serving a useful purpose as a general specification, that further time is desired in which to study the suggestions made in the report of the joint committee of the American societies, and the discussions which are still being carried on in connection therewith, and that printing expense will be saved by refraining from making alterations to the standard specification, your committee desires to recommend that the standard specification for concrete and reinforced concrete be permitted to stand for another year, and that the committee be continued.” Received and adopted.

These Committees Did No Work

Letters were received from the chairmen of the steam boiler specifications committee and the committee on general clauses for specifications, indicating that no meetings had been held and no progress made in their work owing to war activities. It was suggested that Mr. Butler’s motion could be applied to these committees, and that they be discontinued. This was left to the consideration of the new council.

Committee on Society Affairs

Walter J. Francis, secretary of the committee on society affairs, read the final report of that committee, which consisted merely of a brief letter, stating that the committee’s work had been finished, and asking that it be discharged. A motion to that effect was carried.

Portland Cement Specifications

The secretary read the report of the committee on Portland cement, as follows:—

“When this committee was appointed by the council, no instructions were given as to the work to be done by the committee; therefore, in the absence of anything definite along these lines, they thought that the examination of existing specifications would be most beneficial to the society.

“In the United States a joint committee, consisting of representatives of the American Societies of Civil Engineers, the Society of Testing Materials, the Railway Engineering Association, the Concrete Institute, the United States Government, the Portland Cement Association, the Institute of Architects, and other affiliated organizations, was formed in 1904, and have recently prepared and recommended a standard specification for cement which has been adopted by the said societies.

“These specifications, together with the British standard specification prepared by the Engineering Standards Committee, supported by the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Naval Architects, the Iron and Steel Institute, and the Institution of Electrical Engineers, and other most eminent engineers in Europe, were compared and analyzed.

“Your committee, realizing that it is desirable to have as uniform a specification as possible, compared the present Canadian specification with the new American specification and the British specification, and decided that certain features in both specifications did not appear suitable to Canadian conditions.

“Your committee recommends that the magnesia content should not exceed 4 per cent., at least until such time as more information may be had as to the results obtained by the use of a greater amount of magnesia.

“In the American specification, the test for tensile strength with briquettes of neat cement has been omitted. Your committee feel that this test should remain, omitting the 24-hour test and reducing the 7-day and 28-day requirements to 450 pounds and 580 pounds respectively, thus reducing the tendency of manufacturers to produce cement giving a high tensile value on the shorter test, to the detriment of the longer one. The committee considers, however, that more reliance may be placed in the results obtained from the cement and sand tests.

“The Canadian cement manufacturers have objected to increasing the weight of cement in each sack to 94 pounds. Your committee accordingly gave this matter mature consideration and decided to recommend that the weight of 94 pounds per sack, as formerly recommended, should be adhered to.

“Inquiries were made of many of the various works departments of cities and government departments in Canada, to ascertain what specifications were used and to obtain suggested amendments. Replies indicate that the Canadian Society specification was used in most cases, but nearly all seemed to be awaiting the results of the work of the joint committee mentioned before. Since the American specification has been published, numerous communi-

cations have been received from works departments, railways, and others, that they concur with the findings of that committee.

"Your committee, therefore, respectfully recommend the adoption of the specification, as prepared by the joint committee aforesaid, subject to the alterations and additions as herein set forth."

J. A. Jamieson, in discussing the report, said that it should be referred back to the committee, as it does not agree with American or English specifications, and he wanted information on why it should disagree.

R. A. Ross enquired whether it would not be better to adopt standard specifications used by other countries than to try to write separate specifications to meet our own comparatively little needs in Canada without linking up with any outside standards.

A. D. Swan said the committee had put the magnesia content maximum at 4 per cent. in order to split between the English 3 per cent. and the American 5 per cent. In the 7-day test, the committee had followed the English amended specification.

J. A. Jamieson persisted in an effort to find further information as to what had formed the basis of the 4 per cent. requirement. Had the committee conducted any experiments of their own to establish that percentage?

Mr. Swan replied that it was based on 110 letters received from the most eminent engineers in Europe and America; that it was the requirement of the Panama engineers in all Panama Canal work; that it was the requirement of the Public Works Department of Canada; and that it was the result of tests upon which the British standard specification was founded and which he had supervised.

Mr. Jamieson thought that the question was purely a chemical one, combined with the question of the temperature at which cement clinkered, and that unless viewed from that standpoint, any magnesia requirement meant nothing. The Bureau of Standards of the United States had shed much light upon this subject.

Arthur Crumpton stated that the joint committee in the United States had labored over five years on this point, with extensive laboratory research, and that they had found that cement containing 7 per cent. or 8 per cent. magnesia was as good as that containing 5 per cent., and that therefore any lower limit than 5 per cent. was totally unnecessary. R. J. Wig, of the United States government, feels that the joint committee specification meets the requirements so far as they can be met. There is a feeling that the joint committee favored the manufacturers. That is not so. There is a consumers' specification which is practical and has been agreed to by the manufacturers. The manufacturers should not be asked to subscribe to irksome and unnecessary restrictions. The fineness requirement must be considered. By allowing the extra 1 per cent. magnesia, the fineness requirement could be met more cheaply, with the result that as good a cement would be obtained at a lower selling price.

Mr. Jamieson was not sure whether the extra 1 per cent. magnesia would cheapen cement manufacturing costs, but he said that it would have a tendency that way on account of widening the field of materials which would be suitable and thus possibly lower the raw material costs to some manufacturers.

F. B. Brown urged uniformity with the American specification. He advocated the discarding of the neat cement test and the judging of cement by the quality of the mortar it could produce.

Col. Leonard was not in favor of adopting the American specification. Why not write specifications to meet

our own conditions? Why should American work be copied wholesale? Our own committee should be backed up in its investigations.

J. A. Jamieson was strongly in favor of increase of strength with age. The American weakness, he said, is retrogression with age.

Sewage Disposal and Sanitation

Prof. Peter Gillespie offered to the meeting a report which had been made to the Toronto Branch by the branch committee on sewage disposal. After he had read the report, it was referred to council for further consideration, no action being taken on it. The report was as follows:—

"The committee appointed by the Toronto branch, re sewage disposal, has held five meetings since September last, at which many questions connected with sewage disposal were discussed and considered, and at a final meeting held on the 14th instant, it was decided to submit the following recommendations to the branch for submission to the parent society:

"1. That the provincial public health acts of the different provinces should provide that two or more members of each provincial board of health shall be engineers and corporate members of the Canadian Society of Civil Engineers.

"2. That the provincial public health acts should provide that all reports, plans, etc., respecting schemes for sanitation and sewage disposal required to be filed by provincial authorities, shall be prepared, signed and submitted by an engineer, a corporate member of the Canadian Society of Civil Engineers.

"3. That Dominion legislation should be enacted respecting the pollution of international and inter-provincial waters, and that provincial legislation in the different provinces, respecting stream pollution, be made uniform as far as practicable.

"4. That the public health act of each province should give to the provincial boards of health some measure of control over the operation of municipal water purification plants and sewage disposal works.

"5. That all provincial public health acts should stipulate that no municipality can submit to the votes of the electors, any by-laws providing for the raising of money for the construction, alteration or extension of any waterworks system or water purification works, or of any sewage system or sewage disposal works, without having had the approval of the provincial board of health, based on plans, reports and designs submitted by engineers.

"6. That the keeping of accurate and up-to-date records of all extensions and services added to sewer and waterworks systems, should be required of municipalities by the provincial board of health. Where municipalities have no system of their own for keeping such records the adoption of a method endorsed by the provincial board might be insisted upon.

"7. That where provincial boards of health maintain laboratories for the investigation of problems in public sanitation, such laboratories might, under reasonable conditions, and with much advantage to the country, the engineering profession and the boards themselves, be placed at the disposal of this society and, through it, of its members who have problems in municipal sanitation for which they desire solutions.

"The committee proposed to submit recommendations respecting rules and regulations covering the filing of plans, reports, etc., respecting waterworks systems and sewerage systems; first, existing systems, second, projected systems, and third, extension to works, but we

found the time too limited for proper discussion of those important matters. We would, however, recommend that this committee be continued, and that the scope be broadened to more clearly include water supply and water purification and problems of interest to sanitary engineers."

James White said that the Ottawa branch is in favor of engineers being on the boards of health, and that medical men on such boards had admitted that the engineers should have places on the boards. He referred to the recommendations that had been made along this line by the town-planning adviser to the Commission of Conservation.

Award of Medals

The Gzowski medal committee reported its findings and awarded the medal for this year to William Francis Tye, past president of the society, for his able paper on "Canada's Railway Problem and Its Solution." The student's prize was awarded to W. R. Way for a paper on insulated power cables. The Monday afternoon session was then adjourned.

The Fuel Situation

A dinner was tendered the visiting members on Monday evening at the University Club, followed by a smoker and entertainment at the society's headquarters which was attended by a large number of Montreal members and all of the visiting members.

The members reassembled at 10.35 a.m., Tuesday, to hear an address on "Fuels," by B. F. Haanel, B.Sc. Arthur St. Laurent, vice-president of the society, presided. The registration, which had been 68 at the end of the first day, had grown to 101, and the session was well attended. After Mr. Haanel had finished reading his paper, which is printed in full in another part of this issue, Mr. St. Laurent called for discussion.

Walter J. Francis explained that C. A. Magrath, who had intended to be present to take part in the discussion, had been called to Ottawa, and that Mr. Surveyer, of the Research Council, was also unable to be present. Mr. Francis referred to the memorandum on industrial preparedness, which, he said, was responsible for the subsequent appointment of the Research Council, and announced that his confrere in the preparation of that memorandum, Mr. Ross, who was also a member of the Research Council, was present and would take part in the discussion.

J. W. Harkom said that he had been a member of the society since its establishment, and that in his opinion the society had never been presented with a paper of such value and importance as that by Mr. Haanel. From 1874-6, peat fuel from the St. Hubert bogs was used on the C.P.R. It was found perfectly practical to run on that fuel. The peat was pressed into briquettes. It kept the firemen very busy, however, and constantly fell to pieces when shovelled, so it was found advisable to revert to wood, which was used until supplanted by coal. But peat is fuel of value, and more use should be made of it in some districts. The conservation of fuel is the most important problem before Canada to-day. Waste has been the curse of the country from the farmer's woodpile to using coking coal for fuel purposes. By-product plants should be encouraged. One blast furnace he had visited on the Clyde had established a by-product recovery plant which had paid for itself in five years and which shipped tar, creosote, ammonia and other products, in astonishing quantities, to the West Indies and elsewhere.

Mr. Haanel said that the state railroads in Sweden run on peat powder and have found that one and four-tenths tons of peat powder equal one ton of good Welsh coal.

R. A. Ross, member of the Honorary Advisory Council for Scientific and Industrial Research, showed a large map on which was indicated the fuel and water power resources of Canada. He said that when coal is selling at \$130 a ton in Italy and \$60 a ton in Paris, and when we are shivering on the brink of possible stoppage of imports of coal from the United States, we begin to realize how much our civilization depends upon energy. Mr. Haanel's paper shows what a big job the Canadian engineers have to face.

Develop Water Power Resources

Only 12% or 13% of our imported coal, said Mr. Ross, is used for domestic purposes. The remainder is for the production of power. The problem is therefore not solely one of fuels, but one of energy resources, and our "white coal," or water powers, must be taken into consideration.

"The United States has 'treated us white,'" said Mr. Ross. "Next winter, I fancy, we are going to be up against it hard if we do not do what we can to supply our own energy requirements and not lie down supinely. Ontario has no coal but abundant water power for all power needs. The only fuel imports Ontario should need are for heating. No coal should be needed for manufacturing purposes, broadly speaking."

Water powers and fuel resources should be developed jointly, said Mr. Ross, adopting different policy of developments in different districts to meet the different requirements of the districts. Saskatchewan and Alberta, lacking water power, will have to develop their own fuel resources.

By-products cannot be overproduced with economic results. It is an engineering problem to determine when to recover by-products and whether peats and lignites should be burned under steam boilers or made use of by means of gas producers and gas engines.

Pressure should be brought to bear upon the government from every possible source. The whole matter is in the hands of the government and governments rarely act excepting under pressure of public opinion or pressure exerted by private interests. Scientists in the employ of the government have collected an immense mass of information which has been embalmed in green or blue covers and filed on shelves. These scientists and engineers in government service want to put their work to some useful purpose, but they often cannot arouse interest by their own efforts and, said Mr. Ross, "it is up to the Canadian Society of Civil Engineers to help them."

The Research Council has been urging the government to establish a briquetting plant in Saskatchewan, to handle lignite, but so far the government has taken no action. Satisfactory briquettes can be made and a full size commercial plant should be established to see how cheaply they can be made upon a commercial basis. Possibly by-products of the plant could be obtained to cheapen the binder used in the experimental briquettes.

"The fuel situation is an engineering problem," said Mr. Ross, "and the engineers should get into it. If it were a medical problem, the doctors would be in it at once; if it were a legal problem, the lawyers would be there; and if the engineers don't tackle the fuel problem, the lawyers will!"

Possible a ministry of power and fuel might be needed to administer the solution of the problem, said Mr. Ross. The Dominion government, provincial governments and private interests are involved. Some sort of a super-

commission may be needed to get the Dominion and the provinces together on the question without delay.

Walter J. Francis introduced a motion which was passed unanimously by the meeting, that Canada's water powers should be developed as rapidly as possible so that we will be able in time to supply our own needs to a large extent, and not be a burden on the coal resources of our neighbors.

J. B. Challies urged that the Public Works Department, the Department of the Interior, and the Department of Railways and Canals should join forces in this problem, just as the United States departments have done in the recent Water Power Administration Bill.

Engineering Involves the Dollar

Col. Anderson thought that the fuel situation is as much a financial topic as an engineering problem. The question is, where can we get the cheapest fuels to do the work? Mr. Ross replied that it is an economic problem entirely. It is a question of the dollar, but if engineering cannot produce the dollar, it isn't engineering.

In reply to a question about the oil sands of the Peace River District, Mr. Haanel said that they were too far from the sources of cheap fuel required to heat them to recover the oil. They contain only 10% to 12% bitumen, and it does not pay just now to haul a ton of sand a long distance to recover 200 lbs. of bituminous oil.

Col. Anderson called attention to some old experiments tried by the Royal Navy in regard to briquetted Welsh coal, and which were not thought to be very successful, while Col. Leonard brought to the attention of the meeting some experiments on anthracite coal dust, or culm, which have been very promising. Asphalt is used as a binder, requiring only one dollar's worth of oil asphaltum per ton of briquettes.

Jas. White called attention to the value of wood as a solution of the immediate fuel difficulties. General Bertram urged the development of all of our own resources, and instances which he cited showed that the general is a keen advocate of development within Canada, and that he had done a great deal in the past toward initiating Canadian enterprises for the working up of the country's raw materials.

W. J. Dick said that the coal fields in the United States are being rapidly exhausted, and that they may not be able to fulfil the requirements of that country for more than another ninety or one hundred years. The annual production is constantly falling off about 1% per annum, due to increasing difficulties in mining.

A. St. Laurent, assistant deputy minister of public works, urged that a study be made by the society of navigable rivers in reference to power development. He said that his department has to be very careful in permitting developments on such rivers. Not only must the interests of navigation be guarded, but also care must be exercised that in permitting one site to be developed, another better site be not injured.

J. G. G. Kerry did not want the society to discuss power development from financial and economic viewpoints. He thought the engineers should stick strictly to the technical or engineering side of such problems. R. A. Ross took issue strongly on this point, claiming that no body of men is better qualified than is the engineering body, to discuss the broad economics of such national questions. The whole matter is an engineering one. It is purely a question of tracking to his lair, the elusive B.t.u.

As a result of this discussion, the motion previously introduced by Walter J. Francis was again approved heartily by the meeting. The exact wording of the motion was as follows:—

"That this meeting recommend to council the appointment of a committee to make representations to the Dominion Government regarding the advantages and benefits of a progressive system of development of our fuel resources in combination with our water powers to the end that the best uses be made of all of our resources."

Tuesday morning's session was then adjourned.

Unveiling of the Honor Roll

When the meeting was resumed about 3 o'clock Tuesday afternoon, Mr. St. Laurent announced that the honor roll would be unveiled by Lieut.-Col. S. H. Hill, in the absence of Col. Dennis, the president of the society, who had intended to officiate upon that occasion. General Wilson, commander of the Montreal military district, had been invited to unveil the roll, but his duties prevented his attendance. He sent as his representative one of the most distinguished members of his staff, Col. Hill, who had seen years of active service at the front with the Princess Patricias and with the 23rd Battalion.

Mr. St. Laurent said that he felt the unusual solemnity of the occasion, which would be an historic one with the society, particularly as many of those he was addressing had sons at the front.

"I myself," he said, "have a son on service, and I am proud of it. It would have been one of the lasting sorrows of my life if my son had not come to me two years ago and said he desired to go willingly to do his share at the front. However, I am not forgetting that many who otherwise would have been on the Honor Roll to-day have been kept at home and do their work here to ensure the victory and lasting peace we are all looking and working for."

The members then descended to the entrance hall of the society's building, where Lieut.-Col. Hill unloosed the flags which covered the Honor Roll.

"I have been asked by Major-General Wilson," said Lieut.-Col. Hill, "to represent him on this occasion. I find that you have 862 names on your Honor Roll. In face of such a record it would be fulsome on my part to add words of praise for the wonderful showing your society has made."

With regard to the Honor Roll, Lieut.-Col. Hill said that it is believed that over a hundred names should still be added, as there are 200 members of whom trace has been lost, and of whom it is believed at least half have enlisted for service.

Information has been received of the deaths of 58 of the members, most of whom were killed in action, and there is no doubt that others have fallen of whom no records have yet been received. In addition to these, no less than 65 of the members have been decorated for gallantry in action, including Corp. P. L. P. Lecointe, who has won the Croix de Guerre with a star (equivalent to a medal bar), who had been wounded, discharged, and was present at the ceremony.

One past president, Lieut.-Col. W. P. Anderson, had three sons at the front, all of whom had won the D.S.O. Another past president, G. H. Duggan, had two sons killed in action, while another past president, Sir John Kennedy, had lost a son facing the foe.

As an infantryman, Lieut.-Col. Hill spoke in appreciative terms of the manner in which he had seen the en-

(Continued on page 42, Construction News Section)

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CHEMICAL RESEARCH

If the cabled report of the discovery, by United Kingdom interests, of German dye secrets, is correct, a strong weapon against enemy trade after the war will be available. The Imperial, Canadian and United States governments are all devoting considerable attention to the development of the dye and chemical industries. The British government has a substantial interest in an important dye manufacturing corporation and has appropriated a large sum for experiments. The United States government is actively engaged in furthering the dye and chemical industry in that country. Canada has appointed a special commission to investigate these and similar matters. Inquiry is also being made into the production of potash. Germany is said to hold the world's monopoly in this commodity. All the valuable deposits are under German control, the principal source of potash being at Stassfurt. Attempts are now being made in Canada and the United States to produce potash from feldspar and from other resources. A Toronto company is already engaged in experimental work with that object in view and a large Montreal concern has announced its intention to enter this new sphere as a side line. While we must depend upon individual initiative to a great extent for the development of new industries, it is reasonable to expect enterprising governments to encourage experiments of this nature with practical support. The United States, it is understood, has offered as an inducement in research, a large sum to the citizen who can produce potash from one or more of the natural resources of that country, and in quantities which will give an adequate supply.

ENGINEERING INFLUENCE

It is an assumption common enough to believe the idea widespread that for considerable success in any sphere of activity the most important asset is that of influential friends. Indeed, it has been said more than once that the greatest luck which can befall any man is that he chose his parents wisely. Where a belief is widespread there is usually an underlying truth, while it is also not uncommon to find severe limitations to the popular assumption.

Success is not independent of initial advantage, although cases can be quoted where the start was at so low a level as to constitute little or nothing advantageous. What does seem extraordinary is, where men have outstanding initial advantages and do not avail themselves of their birthright. For some reason or other they forfeit the chances of an enviable beginning and perhaps because of the lack imposed by the discipline of circumstance, refuse to fit themselves in the highest manner to an end well within their reach. The man who is without initial advantage has thereby a longer road to travel and he sacrifices some of the best of his youth merely to make a beginning. Still, the lean years, for all their drawbacks, do possess sterling advantages although they must in many ways penalize the individual.

Natural handicaps set by circumstance can be upset by high endeavor, the cases where the very handicap itself has been turned to advantage is proved in the case of many successful men. There is something sure in a foundation which has its beginnings on a solid bottom.

The question of influence has many ramifications. It is perfectly certain that all the influence in the world cannot foist an incapable fool on the community in a professional capacity. He may, however, out of public money, be found a safe job free from competition.

In the professions, and in industry generally, wherever the element of competition is present it ensures some measure of capacity. The initial advantage is often made non-effective by a want of natural sense. It is, as a shrewd technical man once pointed out, extremely difficult to keep brains down. While the final result may be less, the total by comparison is greater.

Whether it is possible to assess success at all, may be debatable.

There is another form of influence not always realized: it is the reaction each individual makes upon his immediate associates, his profession and the time and place wherein he lives. The results are intangible but none the less real, for no man lives to himself, nor ought he try so to do. It is the special privilege of some to exert abiding influence while tangible reward to themselves is lacking.

The question of influence of communal character explains why many capable men tackle troublesome public tasks. It is not so much to be in the public eye as to be of public use to the community. Since each derives advantage—safety, peace and service—from the communal stock, so each should be willing to place themselves in accordance with their capacity at the service of the community. Unless men are public-spirited, democratic government is a failure; it certainly is less successful if men peculiarly fitted withhold themselves and refuse to entertain posts of public responsibility.

Too much has already been left to those who make a trade of the business of government; too little has been done by those having executive ability, high intelligence, education and training. In the interests of the public at large the custody of public interests should be entrusted to a wider range of individuals.

PERSONALS

H. R. SAFFORD, chief engineer of the Grand Trunk Railway, has been nominated for the vice-presidency of the American Railway Engineering Association.

E. A. O'DONNELL, recently appointed superintendent of terminals of the Southern Pacific at Houston, Texas, was born at Navan, Ont., and received his upper school education in Ottawa.

Bomber H. B. NORWICH, a student of applied science, class of 1916, University of Toronto, has returned to Toronto after three years of active service. Bomber Norwich enlisted in the 2nd Division Cycle Corps and went to England with the 2nd Contingent.

Captain R. J. DURLEY, M.E., Montreal, has been made a member of the Order of the British Empire. Captain Durley, who is by profession a consulting engineer, specializing in heating and ventilation, holds a position in Ottawa under the Imperial Munitions Board.

Capt. A. ROSS ROBERTSON, B.A.Sc., of the class of 1909, who went overseas with the 169th Battalion, has reverted to the rank of lieutenant for service in France with the 20th Battalion. He had previously been attached to the headquarters staff at Shorncliffe, England.

Major A. P. LINTON, a student of mechanical engineering, class of 1906, University of Toronto, crossed to France with the 1st Pioneer Battalion, which later became the 9th Canadian Railway Troop. Major Linton enlisted as captain and has recently received his promotion.

Lieut. J. MURRAY ROBERTSON, B.A.Sc., 1914, a brother of Capt. A. R. Robertson, who went overseas with the 14th Battery, C.F.A., has seen service on many fronts. He went over as sergeant but was given a commission in the Royal Field Artillery. He is at present in Palestine.

Lieut. HAROLD H. VROOM, B.Sc., a member of the class of 1910 of McGill University, has had an invention, the Vroom hydrophone, accepted by the British Admiralty. He enlisted in 1916 as sub-lieutenant in the Motor Patrol service, was promoted to the rank of sub-lieutenant in 1917, and is now in the British Naval Service.

Major E. R. BIRCHARD, a B.A.Sc. of the class of 1909, University of Toronto, enlisted in Toronto with the rank of sergeant-major in the Eaton Machine Gun Battery, 2nd Contingent. He crossed to England as lieutenant with this unit, but transferred to the 4th Division Supply Column, C.E.F., for service in France. He was later promoted captain, and in January of last year became C.O. of this division.

SIR JOHN WOLFE BARRY

Death has claimed Sir John Wolfe Barry. He died in London, England, January 22nd. He was born in 1836 and during his illustrious engineering career was connected with numerous important engineering projects. He was appointed by the British government on the Royal Commission on Irish Public Works (1886) and on the Western (Scottish) Highlands and Islands Commission (1889). He was connected with numerous engineering and allied societies, member of the Army Railway Council and consulting engineer to many railway and public works corporations. He was also author of several engineering text books, among them being "Railway Appliances" and "Details of Railway Construction."

FOURTH ANNUAL CONFERENCE ON ROAD CONSTRUCTION

The fourth annual conference on road construction for county road superintendents and engineers will be held in the Parliament Buildings, Toronto, February 25th to 28th, inclusive.

These conferences, which have been held during the past three years, have proved very practical, as they enable those concerned with the design, construction and maintenance of roads throughout the province to meet and discuss various phases of highway work. Problems are brought before many minds trained along the same lines and the general discussions result in the birth of new ideas and the adjustment of old ones, and altogether the conferences have been helpful to all those who have had the privilege of attending them.

In the past the practice has been to have the various subjects on the program introduced by short addresses from engineers connected with the Ontario Department of Public Highways, under whose auspices the conference is held. This year a change has been made and some of the subjects for discussion will be introduced by the superintendents and county engineers.

Many of the papers will be illustrated by lantern slides.

Inasmuch as the 16th annual meeting of the Ontario Good Roads Association will be held in Toronto on February 27th, 28th and 29th, it will be possible for the superintendents and engineers who come to Toronto for the conference on road construction to also attend the last three sessions of the Ontario Good Roads Association meeting. The program for the conference follows:—

Monday, February 25th

Morning Session: 10.30 a.m.—Introductory address by the Hon. F. G. Macdormid, Minister of Public Works and Highways. 11.00 a.m.—"Municipal Drainage as Related to Highway Construction," by G. R. Marston, C.E., Simcoe, Norfolk County engineer and road superintendent.

Afternoon Session: 2.00 p.m.—"Gravel Road Construction in Middlesex County," by C. Talbot, London, Middlesex County engineer and road superintendent. 3.30 p.m.—"Ontario Highway Laws," by W. A. McLean, Mem.Can.Soc.C.E., Toronto, Deputy Minister of Highways.

Tuesday, February 26th

Morning Session: 9.00 a.m.—"Legal and Engineering Features of the Elimination of Grade Crossings," by E. R. Blackwell, C.E., M.Can.Soc.C.E., Brockville, Leeds and Grenville county engineer and road superintendent. 11.00 a.m.—"Better Bridges and Culverts," by A. Sedgewick, Toronto, assistant engineer, Department of Public Highways.

Afternoon Session: 2.00 p.m.—"Bituminous Surfaces in York County," by E. A. James, C.E. (Tor.), M.Can.Soc.C.E., Toronto, engineer to the Board of Highway Commissioners, York. 3.30 p.m.—"Heavy Grading of Earth Roads in Lincoln County," by P. Robertson, Beamsville, Lincoln County road superintendent.

Wednesday, February 27th

9.30 a.m.—"Preliminary Work on Provincial Highways," Geo. Hogarth, O.L.S., Assoc.Mem.Can.Soc.C.E., Toronto, engineer of highways, Department of Public Highways. 11.00 a.m.—"Clay Road Maintenance