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The Canadian Engineer

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The Canadian Engineer.

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For THE CANADIAN ENGINEER.

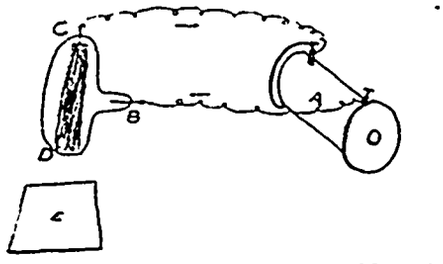
THE NEW PHOTOGRAPHY.

BY C. A. CHANT, B.A., LECTURER IN PHYSICS, UNIVERSITY OF TORONTO.

The new process of picture-making is the remarkable discovery of W. C. Roentgen, Professor of Physics in the University of Wurzburg, Germany; and though the original account of the method was first published in December, 1895, it is now known everywhere. For the reason of this we do not have to seek far. The apparatus used is very simple, and is possessed by almost every reputable institution of higher education; also, the results are so striking and sensational that even the daily newspapers have found it a very fertile source for paragraphs.

The apparatus required consists of a good-sized induction coil, a well-exhausted glass tube and the ubiquitous photographic dry-plate.

The experiment of discharging an induction coil through an exhausted tube is an old and familiar one.



By way of illustration, let us consider the tube *BCD* (Fig. 1), which is one of the many shapes in which they are made. The induction coil is shown at *A*. The platinum wire *B* fused into the glass, whereby the current enters, is known as the *anode;* that where the exit takes place, *C*, is the *cathode*. It will, of course, be remembered that the use of these terms is not confined to vacuum tubes. Perhaps some one may think that as the coil gives an alternating electromotive force, there can be no fixed anode and cathode, but that the current will first enter at *B*, then at the next alternation at *C*, returning to *B*, and so on. But the electromotive force generated at *break* of the primary is much greater than at *make*, and only the former gives an effective discharge. This fact can be easily proved by receiving the shock from a small coil as the primary is slowly interrupted by hand; the effect at "break" will be much stronger than at "make." This effective discharge then enters at *B* and comes out at *C*. Anode means the *path up to* and cathode the *path away from.*

If the air in *BCD* is at ordinary atmospheric pressure, the discharge from *B* to *C* will be of the ordinary jagged, noisy kind. However, as the gas is removed, the character rapidly changes. The crackling noise is absent, and between the electrodes beautiful colored ribbons or striæ occur. These vary with the gas as well as with the pressure, and for exhibiting them, the tube is very generally a cylinder quite long in proportion to its diameter, with electrodes at each end. Such tubes are usually called after Geissler, of Bonn, who first constructed them. For different gases, the pressures at which the discharge takes place most easily, or for which the striations are most beautiful, are by no means uniform; but usually they are a few millimetres of mercury. Frequently the glass is of a sort which will fluoresce when the discharge strikes it.

Dr. William Crookes, the editor of the *Chemical News*, London, made a series of remarkable experiments on these vacuum tubes. On pushing the exhaustion beyond the point at which the best effects of stratification are produced, he found the nature of the phenomena changed entirely. When the rarefaction is very great, about a millionth of an atmosphere, rays are shot out from the cathode, in a direction approximately at right angles to it. In figure 1, the cathode is a small platinum disc, from which the rays are projected against the opposite end *D*. These rays can be focused by a concave mirror within the tube, and can produce intense heating effects—great enough to fuse platinum or melt the tube. On striking the glass they produce brilliant fluorescence. The position of the anode is immaterial, the discharge being always in straight lines from the cathode, with no deviation to suit the shape of the tube. The exhaustion has been reduced, in some cases, to one-twentieth of a millionth of an atmosphere.

Crookes stated his belief that these rays consisted of molecules charged with electricity and shot off at great velocity. This view has not been accepted by all physicists, Hertz amongst others disagreeing, but recent evidence has appeared to support it. The researches of Prof J. J. Thomson,* of Cambridge, lead him to think that these rays are charged *atoms*; and to the French Academy of Sciences on Dec. 30, 1895, M. Jean Perrin†

* See J. J. Thomson—*Recent Researches in Electricity and Magnetism*, chap. 2 Oxford, 1893.

† Translation of paper in *Nature*, January 30, 1896.

presented experiments strongly confirmatory of this hypothesis. These cathode rays can be deflected by a magnet, behaving precisely as a current in a perfectly flexible conductor would in a magnetic field. Crookes also showed that these rays on striking a wheel with very light vanes can make the latter rotate, thus producing a mechanical effect.

Now Roentgen's discovery was that outside the tube peculiar effects may be produced. He wrapped a tube in dark paper, and found that, in a room absolutely dark, substances could be made to light up and fluoresce at every discharge of the coil. He also found that a board or a paper interposed did not prevent the transmission of the effect. Almost every substance was transparent in some degree, though of the metals aluminum was the most transparent, and lead the most opaque, a thin sheet being practically impervious. Afterwards the dry plate was tried; and the fact that this is quite sensitive has caused the perhaps unprecedented scientific sensation of which we have heard so much of late. Not like some sensations, however, there is much genuine and remarkable value at the bottom of it all.

Roentgen next showed that the rays outside are not the same as those within the tube. They did not follow the same laws, and so to distinguish them he called them the X-rays, X here having the common algebraic meaning—namely, an unknown quantity. Hence we see the whole process. The induction coil (and a pretty large one works best, one which will give a 2-inch spark, say,) produces the cathode rays in the tube, and these on bombarding the opposite side of the tube, excite the Roentgen, or X-rays in the ether outside. The latter rays can penetrate some substances easily, others with difficulty, and hence if a hand be placed on the dry plate below the tube—or in the line of the cathode rays—the X-rays pass through the flesh much more easily than the bones, and so on the plate the bones will be shown apart from the flesh—indeed in some cases they come out with startling distinctness.

I may say, however, that the discoverer's theoretical explanation of the new phenomena is not accepted by all. Prof. A. W. Wright, of Yale University, thinks they are the real cathode rays, filtered or modified somewhat on passing through the glass. In England, Prof. Oliver Lodge* and other physicists do not see their way clear to accepting Roentgen's views. They are divided between ultra-violet waves on the one hand and longitudinal vibrations on the other, which latter is the suggestion of Roentgen. At any rate, the theoretical interest is immense.

For best effects the tube should be not many inches from the plate, and the object should be as close to the plate as possible, and, as just mentioned, the cathode rays should be directed towards the object to be photographed. Perhaps the most obvious application is in surgery, since a broken or deformed bone, or the presence of foreign substances, especially if metal, can be shadowed out.

In Toronto the new process has received considerable attention. At both the chemical and physical departments of the University of Toronto many pictures have been taken.

Mr. J. C. McLennan, B.A., of the Department of Physics, working with Messrs. C. H. C. Wright, B.A. Sc., and Jos. Keele, B.A. Sc., of the School of Practical Science, have produced some excellent pictures, some of which are illustrated herewith (Figs. 2, 3). Roentgen made experiments to determine if his new rays were reflected or refracted. With a water or carbon bisulph-

SET OF SPRING BOWS TAKEN THROUGH CASE, EXPOSURE TEN MINUTES.

ide prism no effect was observed; with ebonite and aluminum a possible deviation, giving a refractive index of perhaps 1.05. Moreover the rays seemed to pass through a plate of substance equally well, whether the substance was solid, or in a powdered state. Thus he could not conclude any regular reflexion or refraction. Experiments with metals seemed, however, to point to the probability that platinum, lead and zinc can reflect. On this he says: *

"If one considers this observation (on the metals) with others, namely, on the transparency of powders, and on the state of the surface not being effective in altering the passage of the X-rays through a body, it leads to the probable conclusion that regular reflexion does not exist, but that bodies behave to the X-rays as turbid media to light."

However, in an experiment by the above three gentlemen a porcelain shade was held over the tube and as a result it was found that the time for exposure was very greatly shortened. Using a glass bell-jar over the tube, pictures have been taken through wood with five seconds' exposure, and through several sheets of paper in a single second of time. I have not heard of this effective arrangement being utilized anywhere else.

The practical use of these experiments was very well illustrated a few days ago. A Toronto lady had unfortunately run a broken needle into her foot, and all means to find it were unavailing. However, on taking a picture of the foot there was visible a faint shadow of the metal. Thus it was located and a single incision reached the end of it, about half an inch beneath the skin.

Prof. McKay, of McMaster University, has successfully used a burnt-out incandescent lamp as a

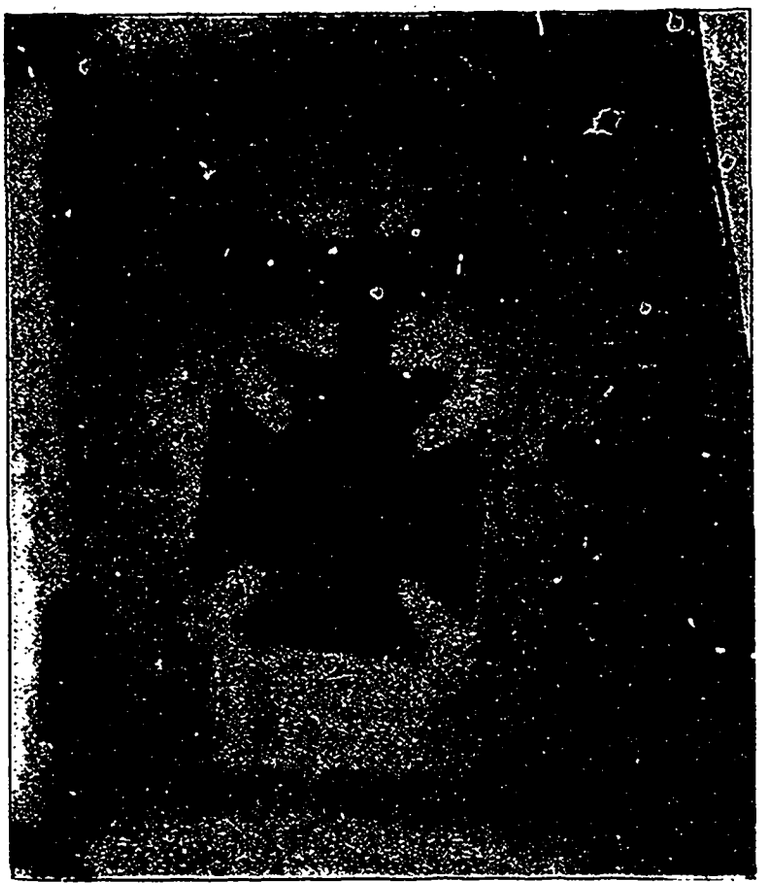
*London *Electrician*, Jan. 31, 1896; reprinted in N. Y. *Electrical World*, Feb. 22nd, 1896.

* For a translation of the original paper, with the discoverer's illustrations, which have hardly been equalled for clearness of detail, see *Nature*, Jan. 23, *Science*, Feb. 15; *Electrical Engineer*, N.Y., Feb. 12; *Western Electrician*, Feb. 15; *Scientific American*, and other papers.

tube. The plaster of Paris of the stem was removed and the leading-in wires carefully insulated by filling the glass cone through which they enter with paraffin. Then on attaching these two wires to his coil the arrangement was complete. It should be remembered, however, that such a tube requires a long exposure, the longer the better.

It is hard to realize how great will be the effect of this wonderful discovery Certainly it is another ether phenomenon, and will assuredly assist in either proving or disproving some of our current theories. The practical applications will also, in all probability, be many. To Dr. Crookes, who did not need this new advertisement to give him fame in matters scientific, this new revelation must be a great satisfaction, and he will probably read again with pleasure the concluding paragraph of his address to the Royal Institution, on April 4th, 1879, when he first publicly exhibited the result of his investigations. It is as follows:—*

"Of the practical applications that may arise out of these researches, it would now be premature to speak. It is rarely given to the discoverer of new facts to witness their immediate utilization. The ancients showed a perhaps unconscious sagacity when they selected the olive, one of the slowest growing trees, as the symbol of Minerva, the goddess of arts and industry.



MEDAL IN CASE, SECOND EXPOSURE.

Nevertheless, I hold that all careful, honest research will ultimately, even though in an indirect manner, draw after it, as Bacon said, 'whole troops of practical applications.'"

THE new discoveries in photography suggest a solution of business difficulties. We want a commercial agency which will "show what's in it" every time.

* See *Nature*, Vol. xx., p. 228, 1879; Proc. Royal Inst., Vol. ix., p. 138, 1879-81.

THE CANADIAN PIG IRON INDUSTRY.

BY GEORGE E. DRUMMOND, MONTREAL.

Concluded from last Issue.

REMARKS.

The time is perhaps very opportune to draw the attention of the leaders of the contending political parties of this country to the fact that the interests of the industrial enterprises of Canada should be as sacred to the one party as to the other. The workmen employed in the respective enterprises are just as deeply interested in the ultimate success of the operations as the capitalists who have risked, and continue to risk, their money in establishing the work.

The iron industry has perhaps greater claims to the good-will and support of the statesmen and people of Canada than any other of the great industries of the country, because the raw material used is wholly Canadian, the product of Canadian labor. It is eminently an industry for which nature has fitted the country, and it is therefore well that it should be encouraged and developed, because it will afford a greater amount of employment to labor for the money invested than any other industry that the country is fitted to sustain.

The progress made should also now be sufficient to prove to capitalists and men of affairs generally, that the enterprise of iron making in Canada can be made a very decided success, affording a splendid field for safe investment It is no longer in an experimental stage, and if many of the investors who are now putting their money into the silver mines of the west, not only of their own country, but of the adjoining Republic, would turn their attention to the production of the most useful of all metals, iron, right here at home, and for the home market, building up every kindred provincial interest, the future of Canada would be most promising. What is wanted now is sufficient capital invested in the various enterprises to enable the iron masters to keep abreast of the times in the matter of modern appliances and methods. Nature provides all the material; it remains for man to utilize them by the best and most economical methods.

The industry has naturally suffered from uncertainty with regard to the tariff question. Barred out, as the Canadian iron manufacturers are, from the American market by the Customs tariff of that country, and handicapped as all iron industries are in infancy, when a very heavy initial expenditure has to be made in construction of plant, prospecting, securing and development of mines, wood, land, quarries, shipping docks, etc., it is imperative that the Government of the country should give stability to the protective tariff, and thus give confidence to capitalists. Statistics prove that the present protection and bounty granted by the Government of Canada, if well maintained, will result in the development of the Canadian iron industry, but the history of the work done in the United States as well as the past history of England, proves that the encouragement granted is not by any means too much for the earlier years of the work. This has been well recognized by Sir Oliver Mowat, who, as the head of the Liberal Government in Ontario, recently carried through an Act by which his Government grants a bonus of $1 per ton for all pig iron made in that province, the product of Ontario ores.

Speaking of the treatment extended to the iron industry by both political parties in this country, neither are quite free from criticism. Special attention is again

drawn to the fact that the Order-in-Council passed at Ottawa, Nov. 2nd, 1894, entitled, "Re drawbacks on imported goods used in Canadian manufactured articles, and exported," still remains, despite the protests and explanations of numerous Canadian manufacturers, who are debarred from doing business with the western agricultural implement makers on account of this order. The order in question, as is well known, was passed with a view of encouraging the exportation of agricultural implements to foreign markets, and provided for a rebate of duty on the material used in machines so exported. It was so framed, however, that the effect has been to compel the Canadian agricultural implement makers to purchase foreign material before they can avail themselves of the drawback. The result has been considerable loss of trade to manufacturers of Canadian pig iron. To be consistent with their policy of encouraging the native industry, the Government at Ottawa, whether it be Liberal or Conservative, must so frame the order in question as to leave the agricultural implement maker free, if he so chooses, to use Canadian material. So much for the present Government's consistency.

On the other hand, the leaders of the Liberal party evidently do not appreciate the iron trade as they should, and do not understand it in a broad sense, and have shown this by the repeated attacks that the leaders, notably the Hon. Wilfrid Laurier, have made upon the pig iron industry of Canada. In several of his speeches, Mr. Laurier has stated that the Canadian iron furnacemen enjoy a protection, aside from the bounty (which all admit was granted for the special purpose of defraying the work of development in mines, forests and at the furnaces), equivalent to an ad valorem duty of from 40 to 60 per cent. To prove his argument, he takes the selling price of southern American coke iron (the very lowest and poorest quality made in the United States) at $6 per ton at the furnaces, and to this he adds a freight of $4 per ton, so as to arrive at what he terms the tax on the Toronto buyer. This is wholly incorrect, inasmuch as the lowest price at which southern iron can be bought to-day is, say, $10.25 per gross ton, and the freight to Toronto from Tennessee or Alabama is $4.60, making the cost, in bond, at Toronto, $14.85, upon which a specific duty of $4 per net ton would be equivalent to an ad valorem duty of less than 30 per cent.; but Mr Laurier entirely overlooks the fact that there is iron and iron, and that to arrive at a fair average of the duty he will have to take into account the fact that Canadian founders use not only northern coke iron, but also higher priced southern coke iron, as well as Scotch coke and American charcoal pig iron. If our politicians, before making such statements, would simply refer to the official statistics on record at Ottawa, say for the fiscal year ending 30th June, 1895, they would find that the importations of pig iron for the last fiscal year were 33,944 net tons, of which the invoice value was $370,574. Figured out at a price per standard ton of 2,240 lbs., this means a value at the furnace of $12.13, to which add an average freight rate of $4 per ton to any point in Canada, *i. e.*, from the furnace in Scotland or the United States to point of destination, and it brings the average cost per ton to $16.13. The specific duty on this at $4 per net ton is equivalent to an ad val. protection of just about 27¾ per cent. As a matter of fact, the present figures, taking into account the high class charcoal iron used in this country, as well as the lower grades of southern coke, will aggregate fully $18 per ton, which would mean a protection equivalent to 25 per cent. ad valorem on the average freight, etc., for delivery at any point in Canada.

SPECIFIC AS AGAINST AD VALOREM DUTY.

As far as pig iron is concerned, a specific duty is the only fair and sensible basis. In the first place, it is the simplest to apply, and does away with possibility of fraud. It would simply be impossible for an appraiser, expert or not, to determine whether a pig iron was worth $12 per ton or $25, so that there would, as far as high-grade iron is concerned, be a wide opening for entering at fraudulent figures, if an ad valorem duty was applied. Then, again, an ad valorem duty would mean a tendency to lower the grade of iron imported, and therefore the class of work produced in this country.

In the case of food, clothes, etc., the argument against specific duties, that the poor man suffers, as he pays an equal tax on his necessity to that paid by the millionaire on his luxury, may hold, but this does not apply to iron, where the quality of pig iron to be used is determined not by the class of people the finished article is to be sold to, but by the purposes to which it is intended to apply it, and a costlier iron, for example, goes into the poor man's stove than into the rich man's furnace. The highest and most expensive grades of iron are used for the production of articles on which human life depends, such, for example, as railway-car wheels, structural work for bridges, buildings, etc. Any one will recognize that it is in the interest of all that the best metal should be used, and nothing done to operate towards bringing into use poor material.

ENCOURAGEMENT OF QUEBEC LEGISLATURE.

It is worthy of special note that the Legislature of the Province of Quebec evidenced, during the last session, a desire to encourage the iron industry in this province by passing the Hon. E. J Flynn's Assembly bill, No. 21, entitled, "An Act respecting colonization of certain parts of this province, and for promoting the mining industry therein." By this Act the Canada Iron Furnace Co., Ltd., are created a colonization society, and 30,000 acres of wood lands are set aside or reserved for the purposes of colonization by the employés of the company. The industry is thus protected against speculators in wood lands, and assured of a constant supply of fuel. The Act is an eminently wise one, and great credit is due to the Hon. Mr. Flynn, Commissioner of Crown Lands, for this fresh evidence of good will towards the mining industry of the province. It will be well for the Provincial Government to grant similar privileges to any furnace company starting work in the Province of Quebec, for while the Act does not go as far in encouragement as that of the Ontario Legislature, it shows good will on the part of our local legislators. It will be well for the people of Canada generally to give this whole question of the development of the iron industry more careful thought, consideration and sympathy.

We have wars and rumors of wars these days. Is it not well to feel that we are self-sustaining in this much abused iron trade?

THE MINERAL RESOURCES OF CANADA.*

BY FRANK D. ADAMS, M. AP. SC., PH. D., PROF. OF GEOLOGY, M'GILL UNIVERSITY.

The Dominion of Canada forms, as we are all aware, the northern half of the continent of North America, and comprises some 3½ million square miles, an area rather less than that of Europe and somewhat greater than that of the United States, and I have been requested to say a few words to you on the mineral resources of this vast territory. Now our knowledge of these mineral resources is derived very largely from the work of the Geological Survey of Canada, and did time permit, I should like first to present to you a brief sketch of the geology of the Dominion in order that I might show you how the mineral wealth of the Dominion is determined by its geological structure. As time does not permit, however, I would ask your attention to the map for a few minutes, while I point out the main great physical divisions into which the Dominion naturally falls.

1. There is the great tract of country whose southern boundary is formed by the north shore of the St. Lawrence from Labrador nearly to Quebec, and which thence stretches westward by Ottawa and Kingston to the Georgian Bay, and then following the line of the great lakes, Huron, Superior, Winnipeg, Athabasca, Great Slave Lake, Great Bear Lake, on to the shores of the Arctic Sea. The country to the north of this line is all composed of extremely ancient rocks—the primitive nucleus of the continent, and forms a great uneven plateau having an area of over two million square miles, the margin of which traced above, was the sea shore of America in these ancient times. We see it as a line of low hills stretching across the horizon when on a clear day we look to the north from the summit of Mount Royal, which hills are generally known as the Laurentian Mountains.

2. Then we have on the western side of the Dominion a series of mountain chains known by various names—the Rocky Mountains, the Cascade Range, the Gold Ranges, etc., which with their intervening plateaus, and the islands off the coast, constitute the Province of British Columbia.

3. Thirdly, there are the great plains which stretch from the foot of these mountains, and to the south of the Laurentians, all the way across the continent, till the Notre Dame mountains in the eastern part of the Province of Quebec are reached.

4. A fourth division consists of the Notre Dame mountains with their northerly continuation known as the Shickshock Mountains, which form part of the Appalachian mountain chain.

5. Lastly, there is that part of the Dominion lying to the east of the Notre Dame Mountains, which constitutes the Maritime Provinces, and which is really in its geological relationships, as Sir William Dawson has shown, much more like western Europe than eastern America, and which may be considered as a portion of Europe here joined to America.

These then being the chief physical subdivisions of the Dominion, let us consider the nature of its mineral wealth and see where its chief mineral deposits are situated.

The mineral wealth of the Dominion consists chiefly in deposits of the following minerals: Coal, iron ore, gold, copper, nickel, lead, silver, asbestos, gypsum, salt, petroleum. Less important are: Iron pyrites, chromic iron, manganese, antimony, platinum, mica, apatite, graphite, mineral paints, etc. There are also very valuable building stones and deposits of clay, sand, etc., used in construction and for various purposes in the arts.

Selecting the most important, coal first claims our attention—the value of the coal raised in the Dominion far exceeding that of any other mineral product. The coal fields of the Dominion lie in two widely separated parts of the country—in the Maritime Provinces on the east, and in the North-West Territories and British Columbia on the west. In the Maritime Provinces, Nova Scotia is by far the most important coal producer. For although the area of the coal formation in the province is small, the coal seams are numerous and thick, one of them actually attaining a thickness of 40 feet. In New Brunswick, on the other hand, as will be seen by glancing at the map, the area occupied by the coal formation is very large; the formation, however, is comparatively thin, the beds are flat and hold but a single coal seam. In Prince Edward Island there is no coal, although there is a possibility of obtaining the mineral if very deep shafts were sunk.

Nova Scotia: The coal areas occupy about 635 sq. miles. So far as at present worked, they may be divided into the Cape Breton, the Pictou, the Cumberland coal fields. In Cape Breton there is the Sydney coal field, the most extensive in the Province, known and worked for over 200 years. It lies on the Atlantic, on the east shore of Cape Breton, and extends 32 miles along the coast and about six miles inland. It forms a portion of the rim of a great basin extending out under the Atlantic. It has been estimated that in this area, within three miles of the shore, to a depth of 4,000 feet, adopting the calculations of the British Royal Commission, there are available 2,000,000,000 tons of submarine coal. The coals are bituminous and coking, and are extensively employed for domestic purposes, and for locomotive and other engines. The Dominion Coal Company, Limited, is the largest operator, hoisting last year nearly one million tons. The General Mining Association, Limited, an English syndicate, has been in active operation since 1825, the average output from its old Sydney colliery being, at present, about 225,000 tons per annum. The Pictou coal field is situated in Pictou county, and is twelve miles long, with a width of four miles at its widest part; the seams are very thick, the forty-foot seam above mentioned occurring in this area. The Cumberland coal field is the most westerly in the Province, and lies, for the most part, adjacent to Chignecto Bay. The principal operations in this field are at the Springhill mines. The Joggins mines are also situated in another part of this area. All the coals of the Maritime Provinces belong to the class of soft or bituminous coals. As has been stated, the coal seams of Cape Breton run out under the sea, and are there worked. In fact, the coal deposits of both New Brunswick and Nova Scotia are merely remnants of a very large basin-shaped coal area, the central part of which has sunk beneath the waters of the Gulf of St. Lawrence, and the opposite edge of which outcrops on the south-east coast of Newfoundland. The coal fields of the North-West Territories and British Columbia occur in more recent rocks. Although the whole area occupied by them has not yet been explored, these coal fields are known to be very exten-

* A paper read before the Applied Science Graduates' Society of McGill University, and published exclusively in THE CANADIAN ENGINEER.

sive indeed. One area of true and lignite coals of the best quality extends along the base of the Rocky Mountains, from the 49th parallel to Peace River, a distance of 500 miles, with an average width of about 100 miles, giving a total area of 50,000 square miles. An additional area, stretching eastward as far as the Souris River and Turtle Mountains, yielding lignites only, may be estimated at 15,000 square miles. These fields have hardly been touched as yet.

Owing to the scarcity of timber these coal fields are of greatest importance in connection with the future settlement of the North-West. The quantity of coal underlying each square mile in some of the best known localities is as follows: Main seam, in vicinity of Lethbridge ("coal banks"), Belly river, coal underlying one square mile, 5,500,000 tons; Grassy Island, Bow river, continuation of main seam, 5,000,000 tons; Horse Shoe Bend, Bow river, 4,900,000 tons; Blackfoot Crossing, workable seam as exposed, 9,000,000 tons; Stair, near Medicine Hat, 5,000,000 tons. Taking the minimum thickness of the Lethbridge main seam at different points along an outcrop of 66 miles, and assuming a workable width of but one mile, the coal in this seam alone would amount to 330,000,000 tons.

In connection with these figures it may be explained that on account of the fact that coal occurs in regular and well-defined beds, interstratified or sandwiched in with the sandstones and shales which accompany it, knowing the dip of the strata and the thickness of the coal seam, it is quite possible by a simple trigonometrical calculation to arrive at the amount of coal under any area and available for use, provided the influence of faults or dislocations can be eliminated. This is not the case with deposits of gold, silver, or other ores, which, being much more irregular in shape and uncertain in thickness, make it impossible to arrive at such results with anything like the same degree of accuracy. In the North-West Territory, as we go west from Manitoba, the coals, which at first are of the nature of brown coal or lignite, gradually change in character to true bituminous coals, and in the Rocky Mountains change into anthracite or hard coal. These latter deposits are extensively worked in the Banff district, and form in fact the only workable deposits of anthracite known to exist in the Dominion. On the Pacific coast in Vancouver Island, there are large and extensively worked deposits of bituminous coal, which constitute the only deposits of first-class coal on the west coast of America, and are on that account of especial value. In output these mines of Vancouver Island rank next to those of Nova Scotia, a large proportion of the coal raised being sent to San Francisco. The following table shows the amount of coal produced by the several provinces last year, as well as the amount exported and imported:

	Long Tons.
Production of Nova Scotia, year ending 30th Sept., 1894	2,200,235
" British Columbia, " 31st Dec, 1894	1,012,953
" Manitoba, " 31st Dec, 1894	10,000
" North-West Territories (estimated)	225,000
" New Brunswick (estimated)	6,000
Total coal production of Canada	3,454,188
Imported (chiefly from the United States)	3,038,586
Exported (chiefly to the United States)	995,998
Leaving as the consumption of the Dominion	5,496,776

The southern portion of our Dominion is thus well supplied with mineral fuel both in the east and west, as well as in its west central portion, but it is a fact, and a most unfortunate one, that in the east central portion, which is the most thickly populated part of the Dominion, no coal is found, and what is still more unfortunate, it is certain, from the age of the rocks underlying this portion of the Dominion, coal never will be found here—a fact which will always necessitate the carrying of coal long distances to reach our principal centres of population.

Iron ores occur in many parts of the Dominion, but they have been worked as yet on but a limited scale, and at but a few points. In many cases the great distance of these deposits from supplies of coal prevents their being worked, but the chief difficulty in the way of the development of our iron deposits lies in the extremely low price of iron during recent years, which permits only those deposits which are most favorably situated to be worked with profit.

Nova Scotia is the province where the conditions are most favorable for the manufacture of iron at present, for there great deposits of excellent iron ore occur in close association with extensive coal deposits and ample supplies of flux, and in consequence a large proportion of the iron smelted in the Dominion comes from the Nova Scotian furnaces.

In the Province of Quebec, also, there are deposits of bog iron ore, which are smelted in small charcoal furnaces at Radnor Forges and Drummondville. Other extensive deposits are known in Ontario, Manitoba and British Columbia; but, with the exception of some of the British Columbia deposits, none are being worked at present. The new furnace which is being blown in at Hamilton, Ont., will, however, necessitate the opening up of some of the Ontario deposits.

The amount of iron ore mined in the Dominion in 1894 was 109,991 tons, valued at $226,611, and of this 108,871 tons was converted into 49,967 tons of pig iron, valued at the furnaces at $646,447, an amount not nearly sufficient to supply the needs of the Dominion. We see, therefore, that although the Dominion possesses great deposits of iron ore and of fuel, it does not as yet supply, or, in fact, nearly supply, all the iron which it consumes. The Canadian pig iron output has, however, increased very rapidly in recent years, and it seems highly probable that before many years have elapsed Canadian pig iron will entirely supplant that now imported from the United States. An interesting point in this connection is the recent discovery by A. P. Low, of the Geological Survey, of enormous deposits of iron ore in the interior of Labrador. These are similar in character and associations to the great iron ore deposits in the Michigan district, and are very extensive, the ore occurring literally in mountains. These deposits, although quite unavailable at present, will probably in course of time, as other and more accessible deposits approach extinction, be profitably worked, and this remote, bleak, and forbidding part of our Dominion will thus be turned to some account.

Gold, which in value ranks third among the products of our mines, comes, like coal, chiefly from the extremities of our land, Nova Scotia and British Columbia being the chief producers of this precious metal. In the intervening portion of the Dominion, however, many other gold fields are known to exist, which may, when opened up, rival or even surpass these older districts. Among these are the auriferous gravels of the Chaudiere District of the Province of Quebec, which occur like similar gravels in California and elsewhere, not only in the beds of the present rivers, but in the old deserted and buried channels occupied by the rivers of former geological times which have long since ceased to flow.

Many of these gravels have been tested and are known to be very rich, much of the gold being very coarse, nuggets as much as 60 ounces in weight having been obtained, while those having a value of ten to one hundred dollars are not uncommon. Almost every stream tributary to the Chaudiere above St. Joseph is known to contain gold, while veins holding gold have also been discovered in this district. Although a very considerable amount of gold has been taken out of this gold field, several attempts to work these deposits on an extensive scale have terminated disastrously, apparently owing to bad management and to the adoption of unsuitable methods; this has given the district a somewhat unenviable reputation, while legal complications have assisted toward the same end. It is believed, however, that a new era is about to be inaugurated for the district, as Mr. Hardman, who has been so successful in opening up the Nova Scotian gold deposits, has now commenced work here. Westward in Ontario, gold is known to occur in the Madoc region as well as at Wahnapitae, and at many other points in the country to the north of Lake Huron, while much attention is now being directed to the Lake of the Woods district and the adjacent territory in Ontario, along the American border line. This district has for the past three years, 1892-93-94, produced annually between $30,000 and $40,000 worth of gold, a beginning which promises to grow to larger proportions through the vigorous prospecting now being carried on. Gold is also found in the sands of the Saskatchewan and other rivers of the North-west Territory, which annually afford a considerable amount of very fine gold dust. About $10,000 worth of gold is annually washed out of these sands, although last year, the water being exceptionally low, some $30,000 worth was obtained. The gold of Nova Scotia occurs in bedded quartz veins, enclosed in rocks of Cambrian age, the gold-bearing series occupying from one-fifth to one-third of the whole area of the province. The actual area, however, from which gold has thus far been obtained is less than 40 square miles, situated in the south eastern part of the province, and this area has up to the present time yielded in round numbers $11,500,000 of gold. Some of these Nova Scotian gold mines are now equipped with plant which for effectiveness and economy will stand comparison with that of any of the gold-producing countries in the world.

Gold was discovered in Nova Scotia in 1860, but as an industry gold mining may be said to date from 1862. Since that time there has been a regular annual yield, varying in round numbers from 10,000 to 27,000 ounces of gold, having a value of $19.50 an ounce.

Unlike that of Nova Scotia, the gold of British Columbia has hitherto been obtained almost exclusively from alluvial deposits—that is, from the sands and gravels of river valleys, either the present river valleys or the valleys of ancient streams long since dried up. Such gold deposits are always derived from auriferous veins along the course of the river, but the gold districts in British Columbia being remote, thus making the transportation of machinery difficult and expensive, the gold is more easily worked in the alluvial deposits, which have therefore furnished the chief supplies. Attention is now being also directed to the rich quartz lodes which occur in many localities, and an era of quartz mining will probably before long be inaugurated.

Gold was first discovered in British Columbia in 1851, but was not worked until 1857, when workable places were found on the Thompson River. In the following year it is estimated that within three months over 20,000 people arrived at the remote trading post which then stood upon the present site of the city of Victoria, while many more made their way overland to the new gold fields. The Fraser and Thompson Rivers were at first the objective points.

The gold found in the lower reaches of the Fraser River was what is known to miners as fine gold, or gold in very small scales or dust; further up coarser gold was obtained, and the miners consequently pushed up till the Cariboo country, some 400 miles from the sea, was reached, and here the richest deposits of alluvial gold, in fact some of the richest placer deposits ever discovered, were found. These for a number of years yielded very large returns. These placers of the Cariboo district are now being worked by means of a very extensive hydraulic plant recently erected, and large returns are being secured. Many other districts in British Columbia also afford gold. Some of these lie to the east of the Fraser, as the Big Bend, Similkameen, and Kootenay districts. In the latter district, the Trail Creek region especially is known to be rich in gold, and is being rapidly developed. Also in the Omimeca district in a latitude of 50° in the drainage basin of the Peace River, and still further north in latitude 58°, is the Cassiar district, first found to be auriferous in 1872. "This," says Dr. Dawson, "is the most northerly mining region in British Columbia proper, but beyond the 60° parallel forming the northern boundary of the province, alluvial gold mining has of recent years been developed in the Yukon district, embracing the numerous upper tributaries of that great river and extending to the border of the United States territory of Alaska." British Columbia has up to the present time yielded gold to the value of about $50,000,000. The greatest output was reached in 1863, when $3,913,563 was produced; since that time, on account of the working out of the most easily accessible placers, the output has gradually fallen off, till in 1893 the production fell below that of Nova Scotia.

There are, however, still immense gold deposits in British Columbia, some of them practically untouched as yet; these, however, being less easy of access, require more capital to work them. This is now coming in, and will undoubtedly continue to flow into the Province during the years to come, causing British Columbia before long to take its place among the more important gold-producing countries of the world.

The production of gold in the Dominion, as a whole, will be seen in the accompanying table. The following figures show the quantity of gold produced last year by the three countries which contribute most largely to the world's gold supply, and may be of interest in this connection. They show that nearly half the gold mined was produced in the British Empire; if we include within its bounds that portion of Africa from which gold is obtained, and which either lies in British territory, or is principally worked by British capital. If to this amount we add the output of the United States, we find that about 70 per cent. of the gold mined last year was produced by English-speaking peoples.

THE WORLD'S GOLD PRODUCTION IN 1895.

Total gold production of world	$203,120,590
United States of America	44,870,998
Africa	44,750,000
Australia	44,000,000
British Empire (including Africa)	97,648,000

The platinum of the Dominion is found with the gold in the alluvial washings in British Columbia, from $1,000 to $2,000 worth being obtained annually.

Copper ore is known to occur at many localities in the Dominion, and copper last year ranked fifth in value among the products of our Canadian mines. It is, however, extensively worked in but three districts—about Sherbrooke in the province of Quebec, in the Sudbury region in the province of Ontario, and in British Columbia. The Quebec deposits are worked principally for the production of sulphuric acid, the copper being in a manner a bye-product, while last year for the first time British Columbia figured as an exporter of copper ore.

The Sudbury deposits, however, are of special interest and importance because in them the copper is associated with the much more valuable metal nickel, these deposits having yielded last year over two million dollars worth of that metal. The ore occurs in what is known as the Huronian system, a series of rocks rich in mineral deposits wherever they have been discovered in the Dominion, and is found about the borders of the great diorite intrusions which break through the stratified rocks of the series. The ores are worked only at a few points where the Canadian Pacific railway cuts through the metalliferous belt, but as the Huronian rocks have been traced by the Geological Survey far up into our northern forests, there can be no doubt but that great nickel and copper deposits as yet unknown exist in this northern country, awaiting a time when they may be profitably developed. Many of these Sudbury deposits are so extensive that they could easily supply sufficient nickel to meet the demands of the whole world, and it is curious to note that their only important competitors are the nickel deposits of New Caledonia, a French penal settlement in the Southern Pacific ocean. The ore in the Sudbury district is roasted and then smelted at the mines; the resulting matte, in which the nickel and copper is concentrated, being shipped to England or the United States for further metallurgical treatment, by which the metallic nickel and metallic copper are obtained.

The nickel thus obtained is used for nickel plating, for the manufacture of German silver, etc., and large quantities have also been employed in recent years for the production of nickel steel, used for the armor plates of battle ships, it having been ascertained that a small amount of nickel when added to steel produces a metal which is not only hard but very tough, and which is thus eminently suited to resist the powerful projectiles of modern artillery.

(To be continued.)

WATERWAYS OF CANADA.

BY THOMAS MONRO, PRESIDENT CANADIAN SOCIETY OF CIVIL ENGINEERS, AN ADDRESS DELIVERED AT THE ANNUAL MEETING, 15TH JANUARY, 1896.

MR. PRESIDENT AND GENTLEMEN,—In vacating the presidential chair of this society, I shall follow the example of my immediate predecessors, and devote the short time at my disposal to a few remarks upon an engineering subject with which I have been for a long time connected, rather than attempt a *résumé* of the general progress of the profession, or even a description of the principal works begun or carried on in Canada during the year just closed.

A brief consideration of the St. Lawrence as the great water route of our country, and its latest artificial improvements, may prove somewhat interesting at the present time, when there seems to be a revival in canals —at least in those of dimensions sufficiently large to enable them to compete, for the carriage of heavy freights, with the vastly improved railways of to-day.

It is not necessary, in discussing this question before such an audience, to give an historical sketch of the inception and progress, up to the period of Confederation, of the various works connected with navigation on the route in question. This has already been ably and fully done by several writers, some of whom are distinguished members of this society.

As, however, you are doubtless aware, a mixed commission was appointed by the Government in 1870 —just a quarter of a century ago—to examine into the question of affording greatly increased facilities for commerce by our water routes, which were then found to be wholly inadequate to the wants of trade. In its report, dated 24th January, 1871, this commission recommended the adoption of a uniform size of lock for the Sault Ste. Marie, Welland, and St. Lawrence canals, the dimensions of which were fixed at 270′ x 45′ in the chamber, with 12 feet on the mitre sills. An estimate of the cost of these improvements was as follows:—

Sault Ste. Marie Canal	$ 550,000
Welland Canal	6,550,000
St. Lawrence Canals	4,500,000
Upper St. Lawrence River	220,000
	$11,820,000

It is difficult to understand why a lock of such proportions was projected. As a matter of fact, "there begins our sadness." No valid reasons are given for it. It neither suited the shape of the large class of vessels then engaged in the trade of the upper lakes, nor any that have since been built. Unfortunately the Welland Canal was constructed on this plan. It was begun in 1873, and completed to 12 feet in 1881, at a cost of about fourteen millions of dollars. The additional two feet cost about two millions more, so that a change from a 10 to a 14-feet draught cost about sixteen millions of dollars. The canal was opened to the latter depth in the spring of 1887. Meanwhile the growth of the upper lake trade was enormous. The registered tonnage of vessels passing the Sault Ste. Marie Canal was in 1870, 690,826. In 1887 it was 4,879,598, while the freight actually carried was 5,494,649 tons. The increase in the size of vessels in this interval was so great that numbers of them could not pass through the enlarged Welland at all. Indeed, the short-sighted policy of 1870 prevented this link in the navigation being placed on a modern basis, and left it as much or more out of date in 1887 as it was when the works were begun, whereas a moderate increase in the length and depth of the locks would have enabled a large part of the lake fleet even of to-day to descend into Ontario instead of being penned up in Lake Erie, to the manifest disadvantage of the St. Lawrence route.

As far back as 1867, Colonel Blunt surveyed several lines for a canal between Lakes Erie and Ontario on the United States side of the Niagara River. His locks were 276 x 46 feet, with fourteen feet on the sills. In 1870, Congress made an appropriation for the improvements projected at Sault Ste. Marie, where the two locks then in existence, although 350 x 70 x 12, were to be changed for a single lock of 18 feet lift, the

dimensions of which were fixed at 515 x 80, with sixteen feet on the sills at mean water.

In 1870, the Milwaukee Board of Trade suggested that the locks on the St. Lawrence route should be made 300 x 45 feet with a depth of 15 feet, and somewhat similar dimensions were advocated by the Board of Trade of Chicago. The lake harbors were well known to be easily susceptible of being deepened to 16 feet, as has been done since ; and even then there was a 14-feet channel through the mud flats of Lake St. Clair. But the commission decided that to exceed the dimensions fixed by them would be to entail an unjustifiable expenditure upon the limited resources of the Dominion.

One of the chief reasons why the Welland Canal cost so much money was owing to the lift of the locks being restricted generally to from 12 to 14 feet. The summit level of the canal from Lake Erie to Thorold is about 18 miles long, and then there is a rapid descent into Lake Ontario. The total fall between the lakes is 326¼ feet at mean stages. This is overcome by 25 locks of about 13 feet average lift each. Had this been arranged for 13 locks of 25 feet lift, a much more direct line could have been selected, and both the first cost and subsequent maintenance of the canal greatly reduced. The lift at the Liverpool docks is about 24 feet at low tide. On the Severn it is much greater. As before stated, the "Soo" lock was designed for a single lift by the late General Poe, one of the foremost of United States Army Engineers. Had primeval practice been abandoned, and concrete substituted for cut stone in the greatly diminished number of locks, the saving which would have followed in the item of masonry alone would doubtless have enabled the Welland Canal to be made of much larger dimensions for the same amount of money, and thus confer a vast and lasting benefit on the St. Lawrence route. The total expenditure on this canal up to the 30th of June, 1895, is $23,764,070 ; before Confederation, $7,638,239 83; since Confederation, $16,125,831.

In the lower canals the dimensions of the Welland locks were adhered to, so that in the enlargement works now in progress on the St. Lawrence, they are the same size, viz., 270 x 45 feet with 14 feet on the mitre sills. On the St. Lawrence canals there has been expended up to the 30th June, 1895, the sum of $23,109,203; before Confederation, $7,471,208; since Confederation, $15,637,990.

The construction of the "Soo" canal was not, however, begun until 1888-9. The progress of events prevented the mistake of adopting small dimensions for the lock there. The result has been a greatly increased size of structure. The first design was for a chamber 600 x 85 feet with a depth of 16½ feet. This was subsequently altered to 650 x 100 feet, depth 19 feet ; and finally, in 1892, the dimensions were fixed at a length of chamber of 900 feet, with a uniform width throughout of 60 feet and a depth on the mitre sills of 20 feet 3 inches at the lowest known stage of the St. Mary's river. The cost of this canal, up to the 30th June, 1895, was $3,256,510. It was opened for traffic last fall. It has aided considerably in passing United States vessels, and in relieving the congested traffic at their lock. It is a noticeable fact that the Canadian trade at this point is only about 4 per cent. of the whole. The Canadian lock is a magnificent structure, and its operation by the electrical method an unqualified success. The result of the improvements at the "Soo" is to make all the four upper lakes practically one for commercial purposes. The "Soo" lock and canal will cost about $4,000,000 when completed.

But this reference is aside from the main object of my remarks, as we have really to consider what the prospects are for an increased trade through the St. Lawrence to our own port of Montreal when the canals (still incomplete) shall have been finished throughout to a draught of 14 feet.

The unparalleled reduction in freight rates on the upper lakes bears directly upon this point, and has been brought about by the great increase in the size and speed of the steam fleet there. To form an idea of this, it may be stated that the total tonnage of the lakes on 30th June, 1895, was 1,241,459. Of this, two-thirds were steamers, and the number of these of one thousand tons and over on the 30th June, 1894, was 359, with an aggregate gross tonnage of 634,467. In the lake ship yards this winter (1895-96), there will be built 65 vessels of all kinds, at a cost of about $8,500,000. Thirty out of the sixty-five are steel freight vessels, twenty of them being steamers. These thirty vessels will average 400 feet in length, and the cargo capacity will average nearly 4,000 tons on a draught of 14½ feet. One of them is 432 x 48 feet. They will cost about $200,000 each. The total carrying capacity of the 42 freight vessels is, on 14½ feet, 136,600 tons gross. Allowing the average number of trips during the coming season, this addition to the fleet will carry about two and a-half millions of tons of iron ore or coarse freight.

As a consequence of all this, grain is now carried from Chicago to Buffalo (870 miles) at about half the cost of 1886. In 1886, the season's average on wheat between these points was 3.6 cents; in 1894, it was 1.2 cents; in 1895 the average was 1.9 cents; but in July last it was carried for 1 cent. It must also not be forgotten that between Duluth, Chicago and Buffalo, works are now in progress which will in the near future secure a channel 20 feet in depth between these points, and this will surely eventuate in a still further and large reduction in lake freights.

A remarkable change has taken place in last year's grain business between Buffalo and New York. In 1894 the Erie Canal carried 42,608,700 bushels ; but in 1895 this had fallen to 14,612,700. The highest canal rate paid on wheat, Buffalo to New York, was 3 cents, the lowest 1⅞ cents, and the average 2⅜ cents. And yet, in the face of these prices, the railways carried double the amount of grain between the same points in 1895 that they did in 1894. It may be said, however, that $9,000,000 have been recently voted for the improvement of the Erie Canal, and that the electric trolley system has recently proved a success in towing a small fleet of steel barges. With 9 feet in the canal, and the "emancipation of the mule," it may be able again to hold its own. At all events, its long competition with the railways has done much in the past to keep at reasonable rates the cost of grain transportation from the great West to the Atlantic seaboard, and has thereby added substantially to the prosperity of the State of New York.

Taking the probable average lake rate in the near future on wheat at 1½ cents, Buffalo charges reduced to ½ cent, and the Erie improved at 2 cents, it is quite clear that 4 cents at the outside will soon carry 60 pounds of grain from Chicago to New York, a distance of 1,368 miles—and pay a fair profit at that.

It is this competitive rate we must face, when upon the completion of the canals to fourteen feet, we shall

be in a position to try for a fair portion of the foreign export trade. It may be said here that the total expenditure on the Sault Ste. Marie, Welland and St. Lawrence Canals up to the 30th June, 1895, was $50,129,783. Of this, about twenty millions were spent prior to Confederation, so that about thirty millions have so far been expended on the enlargement. The works could easily be completed in less than three years from date if so desired.

Great advantages are claimed for the St. Lawrence route, and its praises have been sung for years in somewhat stereotyped phrase. But, nevertheless, "the Western trade does not come this way. The principal reason for this is, of course, that the St. Lawrence does not lead to the chief market. The grain which descends from the lake region is largely consumed in the East, and not exported at all. Take, for example, the receipts at New York for 1894. 123,184,499 bushels were received there by the various routes from the interior, but the freight export was only a little over 62 millions. It is only for the latter half we can compete. We are "not in it" for the balance. Years ago it was thought that if grain once descended on to Lake Ontario, it would inevitably find its way to Montreal, for distribution or export. But it does not. More than half the tonnage which passes east through the Welland Canal is between United States and United States ports, and one of the chief benefits which its enlargement has so far conferred upon commerce is to permit of a line of American propellers being profitably established between Chicago and Ogdensburg. With reference to the foreign export trade of the St. Lawrence, it is a significant fact that the sea going tonnage of the port of Montreal has remained at about the same figure for several years, whilst the trade of Buffalo has doubled since 1886, and was, in 1895, 9,612,423 tons, that of Montreal being officially given at 1,069,386 tons. Even with similar freight rates, the trade will go via Buffalo to New York. The reason of this is not far to seek. New York is the commercial metropolis of North America. It is a great money centre. The imports are enormous, and it is an acknowledged fact that the route upon which a large import trade is done will invariably be the commercial favorite, and command freights both ways. The exports of an agricultural country are naturally bulky and cannot stand high transportation charges. If therefore a route has little or no back freights, it has but a poor chance of success unless the cost of carriage outwards or to the seaboard is so much reduced as to offset the manifest advantages above alluded to. In addition to other drawbacks, the port of Montreal is closed for nearly half the year, whilst those on the Atlantic coast are open all the year round.

During the navigation season, however, Montreal is connected with the sea at Quebec by an artificial channel or submerged canal in the St. Lawrence. This has passed through various phases of deepening, and is now 27½ feet in depth at ordinary low water. It is broad, well lighted, and sufficiently direct to enable ocean vessels to navigate it with comparative ease. The cost of this channel up to the 30th June, 1895, was $3,518,650. The manner in which the operations connected with its establishment have been conducted reflect the highest credit on the enterprise of the city of Montreal, and on the professional skill of Mr. John Kennedy, past president Can. Soc. C.E., who has made several important improvements by which the cost of dredging rock and hard material at considerable depths has been greatly decreased.

Reverting to the subject of the passage of United States vessels through the Welland Canal, it is a fact that before the enlargement took place, and when a small class of vessels was in general use on the upper lakes, this trade, in 1871, amounted to 772,756 out of a total of 1,478,122 tons. In 1880, just before the opening of the new canal to a 12-foot draught, and when the small class vessels were going out, it had diminished to 179,605 tons. Since the opening of the Welland at the increased draught of 14 feet, this trade has steadily grown until in 1893 it was 631,667 tons, representing three-quarters of the agricultural products which were moved on the canal in that year, and about half its total tonnage.

The class of propellers plying to Ogdensburg, previously referred to, now pass through the Welland Canal, carrying 1,750 tons on 14 feet. They are 240 feet long, 42 feet beam, and draw about 15 feet 6 inches when fully laden. At this draught they carry 2,100 tons. The cost of lighterage by the Welland Railway is two cents a bushel on corn, which is the principal article carried eastward, and the detention at the elevators will average three days in a season of ten trips. The additional cost owing to these drawbacks is not less on each boat than $3,000 per annum. If these propellers could descend to Montreal, the question of back freights would determine whether they would pay or not. But the difference of rate between Ogdensburg and Montreal, if added to their 60,000 bushels of cargo, should go a long way towards making the extended voyage a success. At present they carry about 40 per cent. cargo westward, as they run in connection with the Vermont Central Railroad. The line is, it is stated, a fairly successful commercial enterprise.

My views on the whole question of the St. Lawrence route may be considered pessimistic. But it is better to draw attention to the formidable rivalry which may be counted upon for the export of even our own products, than be led into the belief that the St. Lawrence, when the canals are enlarged, will possess a very great superiority over the southern routes, for the export trade of the West.

Nevertheless, it seems to me that so soon as a vessel of say 2,000 tons can get down from Lake Superior to Montreal without breaking bulk, immediate advantage will be taken of this to introduce a cheaply built class of steel propeller and consort of the full size of the locks, and with such reduced running expenses as will enable the present grain rate to be cut in two, or at least so materially reduce charges that we shall be able to wipe out the present antiquated system of transport, and at last stand the chance of getting a fair share of the through trans-atlantic trade.

To show that this is worth fighting for, a few representative figures, illustrating the growth of the great lake feeders, will now be given. The tonnage passing through the Sault Ste. Marie Canal in 1885 was 3,256,628 tons. In 1895 it was 15,062,580 tons, including 46,218,250 bushels of wheat, and over eight millions of tons of iron ore. The quantity of the latter has more than doubled in five years. The totals for 1895 include what passed through the Canadian canal since it was opened in the fall of the year. The receipts of grain, including flour, at Buffalo by lake in 1895, were 162,936,630 bushels, or more than double that of 1885. Chicago shows a similar increase, and the total tonnage passing Detroit, which is about the measure of that coming by water from the upper lakes, was, last year, not less than 35

millions of tons. It is believed that the increase shown by these figures is without a parallel in the history of the world—and the end is not yet. If the St. Lawrence route can secure even the overflow of this enormous traffic, the large sums which Canada has so pluckily spent on her canal system will even yet yield her an abundant return.

But the completion of these canals is urgently required, and an astute American observer has quite recently made the following remarks on this subject. "It must be borne in mind that Canada has not realized the advantages of her great expenditure, because her canal system is not yet complete. The strength of a chain is the strength of its weakest link. The capacity of a navigation system is measured at its point of least capacity. These canals will be finished within two years, and then the Canadian 14-foot system will be in full working order from Lake Superior to Montreal. There will be no weak link in the chain then, and we will feel it pinch." No further time should be lost in securing the substantial advantages of this main line of navigation, which has been under construction since shortly after Confederation. It has cost, as before stated, from the beginning, about $53,500,000, without there being, so far, any adequate return for such a vast outlay.

Before, however, full success can be achieved for the St. Lawrence route, the harbor of Montreal must be adapted for the rapid transfer of whole cargoes from the inland vessel to the ocean steamer. This can best be done by establishing a lower port at the foot of St. Mary's current, and in the vicinity of Longue Pointe. It should be a national undertaking, provided with warehouses, elevators, stock yards, and everything necessary for handling a large through transatlantic trade. Wharves should be arranged so that no time would be lost in taking on heavy freight of all kinds from the railways or lake propellers. Every branch of trade would benefit by this arrangement, and, as before stated, the way from Montreal to the sea is now broad, deep and well lighted, it is believed that the St. Lawrence route would, on the completion of this lower port, at last assume the commercial importance to which it is by nature entitled.

(To be continued.)

For the CANADIAN ENGINEER

PIPE DISTRIBUTION AND WATER SUPPLY FOR FIRE SERVICE.

BY WILLIAM PERRY, HYDRAULIC ENGINEER, MONTREAL.

Inefficiency and mismanagement of the water supply are the remarks that are often heard and stereotyped in current reports of large fires. These reports emphasize the fact that it is absolutely important that each public water-supply system shall be a good and *efficient fire controlling system.*

The best system of water works for fire extinguishing purposes is a gravity system, with the reservoir at an elevation sufficient to give a pressure from 80 to 90 pounds at the hydrants, and not less than 60 pounds at the butt of the play-pipe or nozzle. The gravity system differs from the use of pumping machinery, whether by power or steam, for forcing water through pipes, for this very important reason: it is always ready for immediate use, no delay caused by telephoning or other means of notifying the engineer in attendance. Is not liable to get out of order, as is the case often by incompetent management and inferior machinery. The gravity system has the advantage over the direct pumping system.

To secure an efficient and effective pressure for fire service the reservoir should be as near the city or town as possible to prevent loss of head. With head sufficient to give 100 pounds pressure or 230 feet above the general level of the streets, there should be two mains for general delivery, made of cast iron and tested to 300 pounds before being placed in the trench; said mains to connect to the general distribution supply, connected in such a manner that should one pipe be in any way disabled the other can be used instantly; said mains to be of ample size, that not more than 10 feet head will be lost by friction if all the hydrants in the system were opened at one time.

New systems are being constantly planned by young municipalities, and numberless errors are made by incompetent engineers, having no practical knowledge of the work. It would be advisable and profitable to consider just how far any municipality should go in constructing a water works system without first consulting a thoroughly competent hydraulic engineer. Some municipalities will beg for information, and do the work themselves, rather than consult or employ one.

Making a good fire hydrant service is the form in which the problem comes to the young and enterprising city or town, and the maintenance of the same, where a gravity system supply is insufficient, and the system is supplied by direct pumping from a lake or river. While this reserve may be excellent for household use, it may be unreliable for fire purposes in case of a large conflagration, unless such pumping system is so managed that the reserve plant can be brought into full action. Where the locality does not permit of an elevation to build a reservoir, and reliance is placed upon direct pumping into the mains, direct pumping gives excellent service in many cases, in some cases it has proved a failure in promptly responding, and through necessity it must depend upon some other source to give the alarm of fire and a signal that extra pressure is required on the mains, now comes the point—is there a pressure of steam available to instantly respond to the demand for extra pressure, and a pump capacity available instantly under the circumstances? If not, it cannot compare with a first-class service from a reservoir as far as security is concerned. A thorough knowledge of the volume of water, and rate of discharge of stream to be used, is a first principle in the arrangement of fire streams; to illustrate the value of this, I will add a series of serviceable streams having pressure sufficient to reach given heights as practical fire streams—and to reach seventy to one hundred feet and over, vertically and horizontally, and from nozzles 1, 1⅛, 1¼ and 1⅜ inches diameter. The units, gallons, or million gallons per twenty-four hours, are of frequent and familiar use in water supply statements, and mental comparisons are stated in these terms, and may consequently be easily compared with capacities of distribution pipes, tanks and pumping machinery.

FIRE STREAMS.

Diameter of nozzle.	Pressure at play pipe.	Horizontal projection of stream in feet.	Vertical height of stream in feet.	Gallons per minute.	Rate gallons in 24 hours
1 "	46.5	70	59.5	203	292,298
1⅛"	44 5	70	61.3	249	358,520
1¼"	43 0	70	66.0	306	440,619
1⅜"	41.5	70	67.0	368	530,149
1 "	59.0	80	67.0	230	331,200
1⅛"	55 5	80	69.5	281	404,700
1¼"	53.5	80	72.4	343	493,900

1⅜"	51.5	80	74.4	416	590,400
1 "	79 0	90	76.6	267	384,500
1⅛"	72.0	90	78.5	324	466,600
1¼"	68.5	90	81.0	388	558,800
1⅜"	65 5	90	82.6	468	674,000
1 "	125	100	88.0	311	447,900
1⅛"	103	100	89 0	376	541,500
1¼"	93	100	92.0	460	662,500
1⅜"	88	100	92.0	540	777,700
1 "	100	200	150	292*	.. ....
1⅛"	100	218	157	380	.. ....
1¼"	100	230	167	473	.. . ..
1⅜"	100	243	175	585	.. ....
1½"	100	270	200	680	.. ....
2 "	150	334†	..	..	.. ....

* Using the Eastman nozzle, the best nozzle in use to-day.
† Windsor Hotel, Montreal, Sept., 1894.

By carefully looking over the above table you will observe that if higher pressures are used, that more water will be thrown through the same size nozzle. Distances are with play pipe connected close to the hydrant. Steam fire engines and steam pumps will do the same work, and where heavy streams are required, and Siamese connections used, better results than the figures given in table can be had with long lines of hose and different qualities. Friction losses will increase from 13 to 40 per cent. on a hundred feet of hose. Couplings and washers should receive careful attention.

There is a popular misunderstanding among mechanics in reference to the carrying capacities of pipes and friction losses. The following table will give an idea of head required to produce velocity, velocity in pipe in feet per second, gallons discharged per minute and in twenty-four hours:

Diam. of pipe.	Head in ft. required to produce velocity.	Velocity in pipe in feet per sec.	U.S. gallons discharged per min.	Friction Head. Feet.	Pounds.	U.S. gallons delivered per 24 hours.
4"	.77	7 02	275	52,415	22,704	396,000
	.91	7.66	300	62,196	26,941	432,000
	1.62	10.21	400	109,675	47,502	576,000
6"	.15	3.12	275	7,207	3,122	396,000
	.18	3.40	300	8,522	3,962	432,000
	32	4.54	400	14,855	6,446	576,000
8"	.65	1.76	275	1,812	.785	396,000
	.06	1.91	300	2,113	.923	432,000
	10	2 55	400	3,680	1.594	576,000
10"	.02	1.12	275	.637	.276	396,000
	.02	1.23	300	.746	.323	432,000
	.04	1.63	400	1,268	.549	576,000

A 6-inch pipe is the smallest cast-iron pipe that should be used for a hydrant main, and, comparing pipes on the basis of capacity—

One 8-inch pipe is equivalent to..... 2 05 6-inch pipes.
" 10 " " ..... 3.58 "
" 12 " " ..... 5.65 "
" 14 " " ..... 8.33 "

Doubling the diameter of a pipe increases the capacity four times.

If we compare cast-iron pipe to-day on the basis of cost per foot at $32 per net ton, it will readily be seen that large pipes are the cheapest.

The capacities of water mains increase relatively faster than the costs.

Diam. of pipe in inches	6"	8"	10"	12"	14"	16"	18"
Different size pipes will supply.....	2	3	5	8	12	16	22

The increased draft of water on a pipe increases the friction.

Four-inch cast-iron pipe should never be used for a hydrant main. It will in a few years become so full of rust that it will not supply a 75-gallon stream, which is no use in case of fire. Concentration of water at a given point is of the utmost importance for fire service. The average consumption of water for household use varies from 40 gallons per capita per day and upwards. For fire service it should be doubled in proportion. Where there is no drainage less water is used, and without drains and sewers waterworks should not be built.

Stop valves and gates should be provided where convenient on different sections of the mains for shutting off water in case of repair to broken mains. Accidents are liable to happen in opening streets; they should be placed in locations easy of access and easy to be found in case of necessity. Brick cases should be built around every valve. Mains should not be laid less than 6 feet below the surface of the ground, and the earth well rammed down, removing all stones until the last or top layer. Where gravelly soil is found pipe should go down 7 feet deep, specially so if traffic is carried on to any extent over it. All valves should be of the open-way pattern with brass spindles and square nuts for wrenches.

Two-way frost case hydrants should be used on all cross streets, and in business or mercantile sections four-branch hydrants of a town or city should be used, and on the two-way hydrants, not less than five-inch openings should be had and faucet for connecting six-inch pipe. On the four-way hydrants a seven-inch opening and eight-inch pipe. This is one of the most important parts of the fire distribution plant. Large waterways, and ample means of draining the hydrants when closed, to avoid freezing. A box should be built at the base with open bottom to enable the water to drain off, and when at all possible to run into a drain. Locating hydrants, as far as practicable, should be at the corner of streets, and as close, and as many as possible, not over 400 feet apart. Hydrants are cheaper than hose and require less attention. Long lines of hose are detrimental to good fire service and to the proper working of the hydrant. Considerable bad work is done by contractors, who take hold of water works contracts and know nothing about the first principles of the work. Anything to get it cheap. There should be a rule among corporations building a water works system, that no material should be put into the ground, or covered up, until inspected by a thoroughly competent hydraulic engineer and pronounced satisfactory. The chief engineer of the fire department should, while the work is progressing, make himself fully acquainted with the details of the work, and a plan should be furnished him to make him fully efficient. The only way to have matters in fire systems right is to pay particular attention to them.

Where reservoirs cannot be had and pumping machinery is used, pumping machinery should be in duplicate, and located where supply is inexhaustible.

THE ENGINEER has to apologize this month for some sins of omission, as a number of live topics have been crowded out of our columns. We have come to a point where our advertising pages are crowding in upon the rest of the paper, and we are face to face with our fifth enlargement. Among subjects unavoidably held over are articles on new machinery; on the outrageous dismissal of the city engineer of Victoria, B.C.; correspondence and article on acetylene gas; horseless vehicles; cribwork retaining walls; fire engines; literary notes, and miscellaneous news.

FOURTH ANNUAL MEETING OF THE ASSOCIATION OF ONTARIO LAND SURVEYORS.

The Land Surveyors for Ontario held their eleventh annual meeting—the fourth since incorporation—at Toronto, on the 25th, 26th and 27th of February.

An unusual amount of interest was shown by the members, many of whom had evidently devoted much time and attention to the preparation of papers and committee reports.

In the report presented by the chairman of the Council of Management mention was made of the addition of fifteen new members during the past year, and of the deaths of two of the earlier members, Messrs. Francis Bolger, of Lindsay, and L. M. Bowman, of Toronto. A fact worthy of note was that fewer members are now in arrears than at any previous annual meeting, showing that active interest in the Association is on the increase. The repository and library of the Association, although yet in its infancy, is a most promising feature, and the fund of interesting and useful information contained in its subterranean bay will some day prove of service to the profession and the public.

A new and important departure in some of the papers and reports of committees, is the compilation of court decisions in cases of boundary and drainage disputes, which when published in the proceedings of the Association, will form a convenient reference for the surveyor and ownship engineer when in doubt.

A paper on "The Use of Concrete in Bridge Foundations," prepared by J. DeGurse, engineer for the L.E. & D.R. Railway, gave the author's experience in cases where a safe and inexpensive method of securing durable foundations for structure in quicksands was sought and found.

"Some Notes on Concrete and its Application to Various Works," by M. J. Butler, O.L.S., Mem. Am. Soc. C.E., included among other interesting facts, the results of tests as to the security afforded by concrete in so-called fire proof buildings, and was discussed with much interest.

A paper on "The Maintenance of a Separate Sewerage System," by T. Harry Jones, O.L.S., city engineer of Brantford, gave a detailed account of the actual cost of repairs, flushing, etc., for the Brantford sewerage system, showing that with only a very moderate annual outlay this system had been kept in a most efficient state ever since its construction. This is said to be the first publication given of the practical working of this kind of city drainage in Ontario.

"The Field of American Engineering" was ably dealt with in a paper by A. R. Davis, O.L.S., C.E., of Napanee, and while showing that practical knowledge is most essential, the engineer who combines with it a thorough theoretical training was proved to be much better equipped than his competitors, whose stock-in-trade is experience in the details of certain engineering undertakings and a library consisting of pocket companions."

"Notes on Some New Jersey Roads," by T.B. Speight, O.L.S., of Toronto, gave a description of the vast advantages to all classes of the community in Essex County and other parts of New Jersey, arising from a system of State aid in the building of good Macadam and Telford roads throughout the greater part of that State; and contained suggestions which, it is thought, may help to solve the much discussed problem of the improvement of Canadian country roads, without overwhelming the adjacent land holders with taxes.

A paper on "Road Metal" was read by Herbert J. Bowman, O.L.S., town engineer for Berlin, and gave the comparative cost and durability of the various road materials in use in Ontario, with a reference to the location of the formations in which these materials are found.

"The Ditches and Water Courses Act of 1894" was discussed in a paper prepared by B. J. Saunders, O.L.S., city engineer for Brockville, and its defects pointed out.

Alex. Niven, O.L.S., of Haliburton, in a paper entitled "Ontario Boundaries," gave a history of the various boundary disputes resulting in the treaties and Court decisions which have placed the Province's boundaries in their present positions, subject, of course, to necessary ratification under the code established by the Monroe doctrine.

A very practical paper on "Sectional Surveys" was read by P. S. Gibson, O.L.S., of Willowdale, who for many years has been a member of the Board of Examiners for Land Surveyors, and therefore brings to the subject in hand much experience and consideration. In this paper, after describing the systems of survey in vogue up to 1829, and the failures leading to a radical change of method at that date, the author discusses the sectional system then adopted, and cites numerous instances in which re-surveys under it are not all that can be desired. Candidates for admission as Ontario Land Surveyors will find much information in papers of this kind, and even some of our eminent jurists might, after a perusal, find reason to pause before recklessly condemning the surveyor who has failed to give satisfaction to the proprietors on both sides of his carefully run line.

"Crown Surveys," by James Dickson, O.L.S., of Fenelon Falls, gave the results of his years of experience as inspector of crown lands surveys. The author of this paper paid a high tribute to certain conscientious surveyors, who many years ago ran the standard lines in different parts of the province, from which several series of township surveys have since been projected; also to the members of the Geological Survey staff, whom he terms the pioneers of land surveyors. He also notes a marked improvement in the manner in which contract surveys are now performed, when compared with those of the previous decade.

A. P. Walker, O.L.S., of Toronto, read a paper on "Natural Boundaries," treating of those boundaries which are formed by lakes and streams. A number of important court decisions on these points were cited, and the members of the association will now have a ready reference, by means of which some knotty questions may be decided without the aid of expensive lawsuits of uncertain termination.

In "A Road or not a Road," the president, M. Gaviller, O.L.S., of Collingwood, described a case met with in his practice, and gave the result of appeals from one court to another.

J. W. Tyrrell, O.L.S., of Hamilton, in his paper entitled "An Exploration Survey in the Barren Lands," presented an interesting account of a trip made under the direction of the Geological Survey Department by his brother and himself, with a few Indians, from Great Slave Lake through *terra incognita* to Chesterfield Inlet, and thence down the shore of Hudson's Bay to the nearest Hudson Bay Company's post. This journey is considered to have been more hazardous than the well-known explorations of H. M. Stanley in Central Africa, where the natural products of the soil could almost invariably be counted upon to sustain life, should the supply of luxuries and necessities of civilization fail.

A practical lecture on "The Field Testing of Minerals and the Value of a Course of Instruction" was delivered by W. Hamilton Merritt, M.E., of Toronto, upon the invitation of the council of management. It was listened to with much interest by many whose practice has led them to the rich gold fields of this province, which have so long lain dormant for want of good practical prospectors, provided with sufficient knowledge and a cheap, portable and efficient outfit with which to test the minerals met with.

WILLIS CHIPMAN, C.E., PRESIDENT ASSOCIATION OF ONT. LAND SURVEYORS
(For biographical sketch of Mr. Chipman, see CAN. ENGINEER of April, 1895.)

The nomination of officers for the year commencing 1st April, 1896, resulted in the election by acclamation of Willis Chipman, of Toronto, as president; T. Harry Jones, Brantford, as vice-president; A. J. Van Nostrand, Toronto, secretary-treasurer; George Ross, Welland, and A. P. Walker, Toronto, as auditors.

Eleven candidates having been nominated for the two vacancies as members of council, a ballot was demanded, the scrutineers appointed by the president being H. J. Browne and Captain K. Gamble, of Toronto. The ballots will be opened on the 9th of April.

On the evening of the second day of the meeting the ninth annual dinner of the association took place at McConkey's, among the guests being Messrs. Aubrey White, Assistant Commissioner of Crown Lands, A. Blue, Director of Mines; Kivas Tully, Government Architect, Dr Coleman, Professor of Geology and Mineralogy, Toronto University, and Mr. G. M. Campbell, President of the Engineering Society of the School of Practical Science.

The last feature of the meeting was a lecture by Lieut Peary, U S N , illustrated by numerous lime-light views of scenes in his far-famed explorations in the Arctic regions During the intermission some of the results of experiments with the X-ray photography were contributed by the teaching staff of the School of Practical Science, also views taken by the Tyrrell Brothers in the Barren Lands, and loaned to the Association by the Geological Survey Department In the latter collection were pictures of the vast herds of countless reindeer met with by the explorers.

Notwithstanding an unfortunate misunderstanding which led to much confusion and annoyance in seating the audience at the lecture, all who remained were more than satisfied with the entertainment.

The next annual meeting of the association will commence on the fourth Tuesday in February, 1897.

MAJOR T. HARRY JONES, B. AP. SC.,

member of the Canadian Society of Civil Engineers, is a son of Stephen J. Jones, county judge of Brant. He was for many years major in the Dufferin Rifles of Canada, at Brantford. He put in his time with F. H. Lynch-Staunton, of Hamilton, afterwards joining him in partnership as "Staunton & Jones." He was engaged in many important surveys in the North-West under the Dominion Government, and latterly on the survey of Burlington Beach, under appointment by the Ontario Government. In his private practice he has carried out important drainage works in Waterloo, Brant and neighboring counties. He has been for some years, and still is, city engineer for Brantford. Took his degree at McGill.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

ADOPTION OF THE NEW CODE OF ETHICS.

The following is the code of Engineering Ethics recently adopted by the Canadian Society of Civil Engineers:

DUTY OF THE ENGINEER TO HIS CLIENT.

1.—Every member of the Society should perform the work he undertakes to do to the best of his ability and in the true spirit of his engagement, feeling it to be his duty to present all ascertained facts in their true light.

THE CLIENT'S OBLIGATION TO THE ADVISER.

2 The civil engineer has a right to expect from his client the same consideration and deference to his opinion as is by their clients accorded to the members of other professions—Law and Medicine for example—and without which the adviser should decline to advise. The surest way for the engineer to obtain such necessary consideration and deference from the public will be found in his manner of carrying himself.

MUTUAL RELATIONS OF CHIEF AND ASSISTANT.

3.—The assistant engineer must loyally obey and support his chief, to whom it will be his duty to report directly on all matters relating to the work on which they may be jointly engaged His report should be full and explicit on all important points, and exact to the best of the assistant's knowledge and belief, cloaking nothing, even though going to show that previous reports had been inaccurate or not unduly weighed in some particulars affecting the well-being of the business in hand.

4—The assistant engineer is entitled to look to his chief for, and to receive from him, advice for his guidance in the proper performance of his duties, and where right, to expect his support in matters in dispute between him (the assistant) and his subordinates, or between him and the contractors working under him. He is also entitled to the aid of the chief engineer's professional experience or counsel where unlooked for or extraordinary difficulties present themselves, or changes of original plan may be called for in the work on which they are associated, so that responsibility may be fairly apportioned between them.

5.—It is the duty of both chief and assistant, each in his department, to study proper economy in the doing of the work, the management of which they have undertaken, and in every way consistent with the maintaining of the good character of the work to make the client's interest the guiding object.

6—The engineer may legitimately suggest experiments with a view to improvement, whether in methods of doing the work which he oversees, or for raising its character, but such experiments should only be undertaken with the full consent and co-operation of the party, whether client or contractor, on whom the expense may fall, and on the understanding that to them will accrue all pecuniary benefit from the success of the experiment.

7.—It shall be considered unprofessional for any member of this society to seek the position of an expert, to report on any work that is in charge of a recognized engineer.

8.—It shall be the duty of any engineer before examining any work, with a view to report thereon, to give the engineer due notice before going on with the investigation, in order that he may have every facility to explain and sustain his methods of carrying on the work in question.

PROFESSIONAL SERVICES OF ENGINEERS TO EACH OTHER.

9.—Interchange of professional assistance between members, as tending to promote fraternal intercourse and mutual good-will, is not to be discouraged, but neither is it to be considered obligatory on a member to respond to the request of a fellow member for professional counsel or assistance. Services so rendered must be entirely voluntary on the part of the member whose aid is sought.

PECUNIARY MATTERS, ADVERTISING, ETC.

10.—The civil engineer may consistently with professional status take out patents for new inventions or for improvements on old ones, and may sell or otherwise dispose of the patents for his own advantage. He may undertake surveys and the engineering of works by contract, or he may take contracts for the construction of works on a percentage of their cost. Advertising with a view to attracting business should, where resorted to, be as far as possible free from egotistic or self-laudatory references, and expressed in language not derogatory to the dignity of the profession.

DUTIES OF THE ENGINEER TO THE PUBLIC.

11.—The civil engineer whose advice is sought in respect to the usefulness, practicability and cost of a work, should before expressing his opinion obtain reliable information on all points involved in the matter submitted to his judgment, including the probable paying capacity of the contemplated undertaking. He must be cautious how he recommends large preliminary outlay; should avoid connecting himself with schemes or projects of merely speculative character, always bearing in mind that his professional reputation will be to a great extent judged by the inherent merits and commercial value of the undertakings with which his name may come to be associated.

At the ordinary meeting of the society held at 112 Mansfield street, Montreal, on the 13th February, the president, Herbert Wallis, presided The evening was occupied in the discussion of W Bell Dawson's paper on "Retaining Walls," in which Messrs. H. Irwin and J. G Kerry took a prominent part.

At the meeting on Thursday, February 27th, at which the president also presided, a paper on the Penn Yan (N.Y.) waterworks, by Angus Smith, student of the society, was read by the secretary.

There was also a debate on the following resolution: "That engineering works should be constructed by day's work under the immediate direction of an engineer, instead of being done through a contractor." The debate was opened by W. J. Sproule, and was taken part in by Messrs. Wallis, Irwin, Smith, Kerry and others.

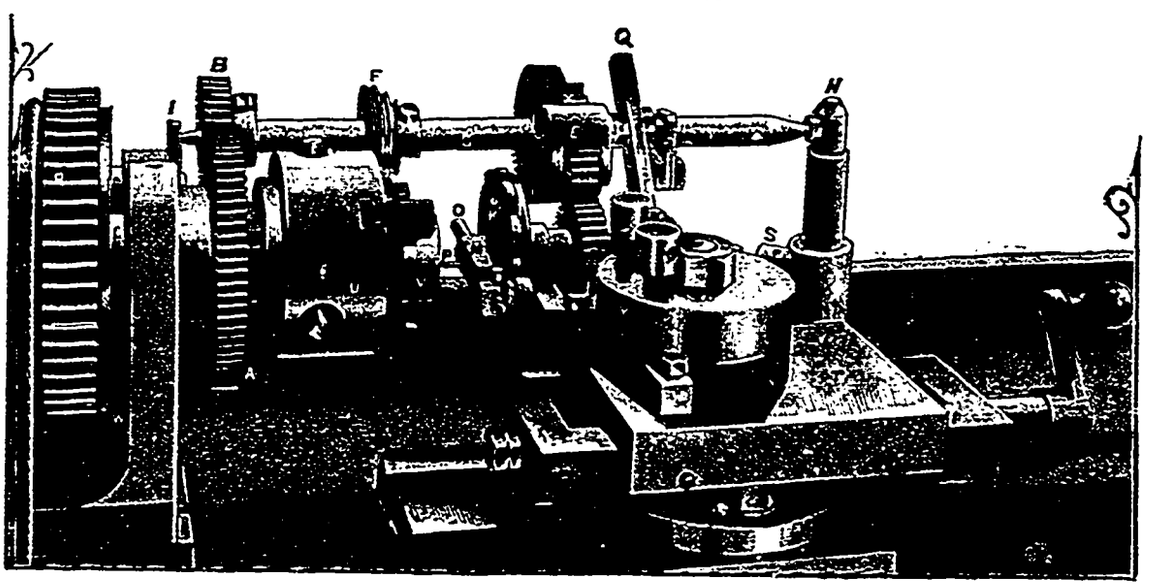
CUTTING MACHINE FOR COMPOUND GEOMETRIC WORK.

This apparatus meets a long-felt want, viz., that of a cheap and efficient appliance for performing in the handiest manner, and by an entirely new method, a singular variety of ornamental work in the lathe, some of it entirely new, and the rest hitherto out of the reach of most amateurs owing to the prohibitive prices of the various instruments, each doing one special kind of work only. The surface designs which may be produced are absolutely unlimited in number and variety, and their character again is entirely altered when deep cuts to show facets with, say, a broad round-nosed cutter Any epicycloidal pattern, having a decided loop, may be cut in this manner.

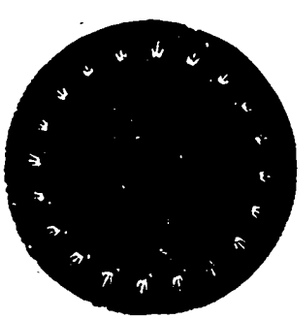
All manner of the most beautiful work may also be executed with this appliance on the cylinder. It can be used in any lathe that is provided with a slide-rest and an ordinary jaw chuck, the only fitting or alteration required being a wheel fitted to the chuck (or mandril), and a movable bracket bolted to the mandril-head. (For vertical cutting a plain spindle with no graduated arm but a hole and a set-screw to take the cutters is preferable, and for spiral work on the cylinder a fixed collar and a wheel added to the slide-rest is also required.) For the epicycloidal and compound geometric work no overhead motion, or division-plate and index, is required, and if the slide-rest is not an ornamental one, any graduation required on it is easily done by the aid of the instrument itself. Its strength and simplicity are notable points, and there is little doubt when its capabilities have become known and are realized that it will form an indispensable adjunct to the lathe, as it is not a toy, but a really useful tool for a great variety of purposes.

means of the jointed arm *R*, they may be kept in gear with wheel *C*, so that by slackening the set-screw, which retains the arm *Q* in any desired position, the slide rest may be advanced to or from the centre of the work *V* to be ornamented, all the wheels remaining in gear and with exactly the same play between the teeth. By fastening a spring at one end of bar, and attaching to it a glass pen or a pencil, designs may be traced on paper instead of being cut, with, however, some slight and unavoidable loss of accuracy as compared with the fixed cutter.

For spiral and twist cutting on the cylinder, the cutters are fixed in the spindle used for vertical cutting, and revolved in a similar manner, *i.e.*, direct by the overhead motion. The bracket *I* is bolted on the front part of the mandril head (or if sufficiently long, and curved, in the same position as described), and the hand-rest containing the pillar *H* is brought forward so that the shaft *G* is in front of the work to be ornamented, instead of behind it as before. This new position obviates the necessity of using very large wheels, and also allows of the poppet-head being advanced to support the work if desired.

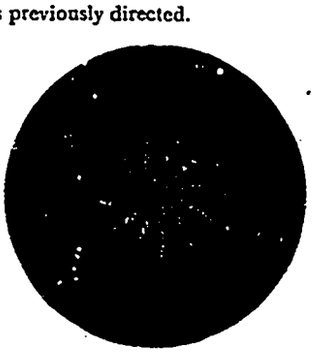


The above engraving shows the apparatus as fixed in an ordinary lathe ready for surface cutting. *T* is an ordinary slide-rest, in which is clamped the frame *L*,*L*, carrying a revolving spindle (called the tool spindle), on which is fixed by a set-screw the



wheel *D*, the boss being to the left and close to the frame, which prevents the spindle from moving to the right or left. This wheel is connected with the wheel *C* on shaft *G*, by means of the carrier-wheels *X*,*X*, fixed in the frame *E*, which is in turn fixed in any desired position by means of a screw and nut to the adjustable arm *Q*. This arm is centred upon one of the steel collars in which the tool spindle works, so that in whatever position it is fixed the carrier-wheels always remain in gear with wheel *D*. Similarly, by

A collar is fastened to the slide-rest, and centred on the handle, and on this collar the arm *Q* works, just as on the projecting collar of the frame, the carrier-wheels being bolted on the right-hand side of it instead of on the left. These wheels gear with a small wheel fixed on the handle of the rest (the latter traversing the tool during the cutting of the twist) and with the wheel *C* on the shaft *G* as before; wheel *B* gearing with wheel *A* on this side of it, instead of at the back as previously directed.



By using wheels of various sizes, the twist or spirals will be varied accordingly. A few samples of the work are here given. The makers of this machine are the Britannia Company, Colchester, England.

COUNCIL OF THE C.S.C.E. IN 1896.

In the issue of May, 1894, THE CANADIAN ENGINEER gave portraits and biographical sketches of the officers of the Canadian Society of Civil Engineers for that year. We have the pleasure of presenting to our readers in this issue some interesting facts about a number of those on the council for the present year. Among the officers for 1896 are a number who have appeared in our pages before, and of these (as Herbert Wallis, president; Prof. H. T. Bovey, vice-president; K. W. Blackwell, treasurer; Prof C. H. McLeod, secretary; W McNab, librarian) we say nothing here.

CHARLES M'DONALD, C.E., LL.D., VICE-PRESIDENT.

Charles McDonald is a lineal descendant of Joel Stone, founder of Gananoque. His early education was derived from the preparatory school of Queen's College, Kingston. After some preliminary experience as an assistant in the surveys then begun for the Grand Trunk Railway, he entered upon a professional course of three years in the Rensselaer Polytechnic Institute, Troy, N.Y., and graduated from that institution as a civil engineer in 1857. He has since devoted himself to the laying out of railways, and, more particularly, to the construction of railway bridges, many of the largest in the country having been constructed from his designs. Among other works, he secured, under severe foreign competition, the construction of the Hawkesbury River bridge, in New South Wales, Australia—which is remarkable as requiring the deepest foundations in the world He is a member of the firm known as the Union Bridge Company, is vice-president of the American Society of Civil Engineers, and a member of the Union, University and Century Clubs. In April last he received the degree of LL.D. from Queen's University, Kingston, Ontario.

*GT. GEO. BOSWELL, B SC., FELLOW IMPERIAL INSTITUTE, F.L S., C.E.

Graduated in Faculty of Applied Science, McGill, 1874, obtained a first-class certificate, short course, in the Quebec School of Gunnery, October, 1874, was employed as assistant engineer on Coutour survey of Mount Royal, and in the city engineer's office, Montreal, from October, 1874, to April, 1877. In April, 1877, he was appointed assistant engineer on the Quebec harbor works; in 1880, general assistant engineer on the Quebec harbor works and Levis graving dock; in 1886, resident engineer, and in 1891 chief engineer to the Quebec Harbor Commission, which position he now holds. Mr. Boswell has also done considerable work as a consulting engineer. He was consulting engineer for the city of St. John, N.B., for projected harbor improvements estimated to cost over $1,000,000; for projected harbor works at Moncton, N.B.; was inspecting engineer of the Halifax graving dock for the Federal Government. He designed and superintended the erection of two steel towers, 116 feet high, and did other work for the Quebec Electric Light Co., and is now engaged designing and superintending the construction of cold stores and warehouses for the Quebec Cold Storage Co. He is a member of the I.C.E., a land surveyor for the Province of Quebec, and is a Fellow of the Imperial Institute.

*Member of the Executive

*MATHEW JOSEPH BUTLER, D L.S., M.I.C.E., M.S.A., LONDON, C.E.

M. J. Butler was born in Deseronto, Ont., 1857. He was educated at public and private schools and Toronto University, where he took up a special course in mathematics, physics and science, 1874-78 After serving three years under articles, he was admitted to the Ontario Land Surveyors, 1878, and Dominion Land Surveyors in January of the same year. He became a member of the American Society Civil Engineers in April, 1885, and a member of the Institute of Civil Engineers the same year. He has been a member of the Canadian Society of Civil Engineers since incorporation, and attended the first meeting held for organization in Toronto. He is also a member of the Society of Arts, London, England. From 1878 to 1882 he was engaged in Government surveys and private practice. In 1883 he located the northern end of the Kingston and Pembroke Railway. He was engineer and superintendent of the construction on the Thousand Islands Railway in 1883 and 1884; chief engineer, Napanee, Tamworth and Quebec, 1835 and 1886; engineer for buildings and water service in Atcheson, Topeka and Santa Fee Railway in Kansas, Missouri and Colorado, in 1887-88. He was engineer and manager wood pulp mill, Riviere du Loup, Que., in 1889 and 1891. From 1891 to present time he has been chief engineer for the Rathbun Company of Deseronto, which includes the Bay of Quinte Railway and Navigation Company, the Thousand Islands Railway, the Oshawa Electric Railway (the first electric railway built to standard gauge for freight work); also the Napanee mill, Portland cement works, general mill work, lumbering operations, slides, dams, etc. He was president Ontario Land Surveys Association, 1894; author of paper on "Cements," in the transactions of the Canadian Society of Civil Engineers. "Lumber Industry in Ontario," in proceedings of the Institute of Civil Engineers, London, England.

W. R. Butler holds the chair of civil engineering at King's College, Windsor. Mr. Butler came to Nova Scotia from England, and entered (in 1875) upon the course in civil engineering at King's College. During this course he won several prizes and scholarships, and obtained in 1878 a first-class degree of "Bachelor of Engineering," his final degree examination being conducted by officers of the Royal Engineers. He entered the service of Messrs. Watson, Smith & Watson, civil engineers of London (Eng.), and was appointed to the staff engaged in construction of the Swindon, Marlborough and Andover Railway in England. In 1880 he was

*W. R. BUTLER, M. ENG ; A.M.I.C.E.

elected to the chair he now holds. Since then Prof. Butler's available leisure has been devoted to practical work. Important works have been carried out in Nova Scotia from his design, and under his direction. Amongst such may be mentioned the Cornwallis Valley Railway, the system of water supply for the towns of Wolfville, Antigonish, and Canning. In connection with such works many of the students in engineering at the university have thus had opportunity of gaining, in addition to their theoretical training, a practical experience which has in many cases enabled them to fill positions of no little professional responsibility on completing their course.

*W. BELL DAWSON, M.A., M.E., C.E.

W. B. Dawson is a graduate of McGill University both in Arts and Engineering. After leaving McGill, in 1875, he studied until 1878 at Ecole des Ponts et Chaussées, Paris, graduating first in his class. He became P.L.S. in 1878. In 1881 he made a topographical survey of a portion of the gold fields of Nova Scotia. He was appointed assistant engineer of the Dominion Bridge Co., 1882, and in 1884 he became assistant engineer to P. A. Peterson, chief engineer of C.P.R. In 1893 he was appointed engineer in charge of the Tidal Survey, Department of Marine, Ottawa.

E. H. Keating was born in Halifax, N.S., in 1844. He was a schoolmate of the late Sir John Thompson, and completed his education at Dalhousie College. After graduating, he served for a while under George Wightman, the Government Engineer. Mr. Keating took part in the survey of the Pictou Railway in 1867 under that famous engineer, Sandford Fleming. A little later he was appointed assistant engineer of the Intercolonial, then in process of survey. For a short time he was draughtsman on the Windsor and Annapolis, and then he returned to the Intercolonial during the construction period. During 1870 he was engaged, again under Sandford Fleming, in making surveys north of Lake Superior for the C.P.R. From 1870 to 1890 he was city engineer of Halifax, and was employed in the construction of the waterworks and graving docks. His engagement with the city of Halifax enabled him to carry on outside work, and during this period he was eminently successful. He accepted a position as city engineer, at Duluth, in 1890, and remained there until July, 1892, when he became city engineer of Toronto. During the time Mr. Keating has

*E. H. KEATING, C.E., CITY ENGINEER, TORONTO.

been in Toronto many important works have been carried on. The changing of the street railway from horse to electric traction required a high degree of vigilance and ability. His recommendations with regard to the Toronto water works, though they were undoubtedly correct, as since shown by the Mansergh Report, did not meet with approval of the ratepayers, who had apparently determined on economy without regard to result.

*HENRY IRWIN, B.A. TRIN., D.L.S., C.E.

Henry Irwin graduated in Arts at Trinity College, Dublin, in 1870, and in the same year graduated with honors in Engineering. He was assistant to the surveyor of County Antrim from July, 1872, to July, 1874; his duties being connected with the construction and repair of macadamised roads. He came to Canada in September, 1874, and on 1st October commenced work in Montreal as assistant to Joseph Rielle, P.L.S., remaining in that position till 1881, when he became manager of the surveying branch of Mr. Reille's business. In 1885 he outlined the present successful scheme for protecting Montreal from floods due to rise of the River St. Lawrence. In July, 1886, he became a P.L.S for Quebec Province, and shortly afterwards qualified to act as a D.L.S. In June, 1887, he took a position as assistant engineer and Provincial land surveyor on the staff of P. A. Peterson, chief engineer of the Canadian Pacific Railway, which position he still holds. In 1890 Mr. Irwin won the first prize of $400 offered by the Good Roads Association of Pennsylvania for an essay on the construction and maintenance of roads.

W. G. Matheson was born in Stellarton, N.S., and was educated at Chatham (N.B.) Grammar School, and University of New Brunswick. After completing his education he put in some time in a machine shop in New Glasgow, N.S., afterwards going to Scot-

*W. G. MATHESON, C.E.

land, and serving in the drawing department, and the workshop of Den's Works, Dundee, and afterwards in the works of R. Napier & Son, Glasgow. Since returning to Canada Mr. Matheson has retained his connection with the latter firm.

*W. J SPROULE, B A..C , M E., D L S., C.E.

W J Sproule is a native of Ontario, and was educated at the British American Commercial College, and Collegiate Institute, Toronto, and McGill University, Montreal, graduating B.A.Sc 1877, and M E., 1885. In 1877 he entered the office of the Montreal Harbor and St Lawrence Ship Canal works as assistant to John Kennedy, C E , where he was employed almost continuously until present day Part of 1877 was spent as assistant engineer to the late John Page on the enlargement of the Lachine Canal. Until 1881 he remained in the Harbor Works office, and then took a position as assistant engineer on the Pittsburg, McKeesport, and Youghiogheny Railway. He was engaged some time in surveying in the North-West and Lake of the Woods district, and in the location and construction of part of the C.P.R. in the Rocky Mountains. In 1887 he superintended the building of the dyke along the river front of Montreal. Mr. Sproule is a Provincial and Dominion land surveyor, and President of the McGill Applied Science Graduates Society.

W. D. Barclay has had a varied experience as a civil engineer. During 1867 and 1869 he was assistant engineer on the western extension of the E. & N.A. Ry. He was also assistant engineer on the Maine Central Railway, 1869 and 1870; divisional engineer on the Prince Edward Island Railway, superintendent on the Parrsboro' and Bay Verte Canal survey, 1870-74, engineer in charge for Eastern Counties Railway, N.S., 1874-75, assistant-engineer Intercolonial (Metapedia), 1876-79, he was on surveys and construction of the C P.R Western Division, 1879-80, divisional engineer of the C.P.R. Western Division, 1880-82, assistant chief engineer, C.P.R. Western Division, 1882-83; acting chief engineer C.P.R. Western Division, 1883-85; chief engineer, N.W.C. & A. Company, Lethbridge, 1885 and '86; divisional engineer G.N. Railway surveys and construction, 1886-89; engineer for construction of the Eastern Railway of Manitoba and D. and W. Railway, 1888-90; chief engineer and superintendent of the construction on the Alberta Railway and Coal Company, G.H C.A.L.C. Company, 1890; general superintendent of the A R.C. Company 1890-94; manager A R.C Company, 1894 to present time Mr Barclay has been continuously engaged in railway work since 1867

*W. D. BARCLAY, C.E.

For THE CANADIAN ENGINEER.

RESULTS OF THE TIMES-HERALD MOTO-CYCLE CONTEST IN CHICAGO.

With the advent of the steam engine it was found necessary to compare the rate at which an engine could do work with that at which a horse could do work, in order that the purchaser of an engine could specify the power required in units with which he was familiar. As the power that the average horse was capable of exerting had been but indefinitely determined, experiments were made by James Watt to obtain definite figures, the result was that a weight of 150 lbs. could be raised by a fairly good horse at the rate of 220 feet per minute. So that 33,000 lbs., the weight raised 1 foot high in one minute, was designated 1 h.p., and has been the standard from the time of Watt to the present day.

It was found that this power could be exerted for a certain period, or for a fewer number of hours a higher rate of doing the work could be developed. A horse could exert a heavy pull at a low speed or a lighter pull at a higher speed, it is also capable of exerting a wide range of pull, which makes it particularly suitable for running vehicles. The determinations actually made of the pull required of a horse in pulling a vehicle are not very numerous or accurate, as owing to the fact that the pull is apt to be irregular, many difficulties are encountered in measuring. In order to still further compare the performance of the moto-cycle with that of the horse, efforts were made to determine the maximum pull that the vehicle could exert as compared with that of the horse. It is evident that this would be only of interest as determining the performance of the vehicle when operating under extremely unfavorable conditions. In this connection it is only fair to add that the vehicles were designed for a light passenger service and not to exert a heavy pull, so that a medium pull exerted at a high average rate of speed was the object sought for, rather than a heavy pull under adverse conditions. For determining these conditions the pull on the moto-cycle was increased until the limiting conditions were reached. It is apparent that heaviest pull exerted, namely, that with Duryea vehicle, amounted to no more than 187 lbs., compared to 400 lbs., which a single horse could exert for a short time. It was not possible in any of the tests to slip the driving wheels so that the traction in all cases was ample; if a greater driving power had been available by means of reducing gearing, or otherwise, it would probably have been possible to obtain a correspondingly high result.

In the case of the belt-driven machines of the Benz type, the limit was usually reached when the belts slipped, owing to their defective condition. On the Macey machine, which possessed one of the most powerful motors of any of the vehicles submitted, the maximum effort was not obtainable. The Lewis moto-cycle was equipped with a special reduction gear, enabling a very heavy pull

to be produced. The effort to obtain this heavy pull from the vehicle resulted in the breaking of the driving chains. Under these conditions, it is hardly fair to consider the results as the best obtainable; in the machines directly geared any attempt to obtain heavier pulls than those given resulted in stalling the motors. The pull obtained by electric vehicles is only limited by the heating effects of the excessive current required. There was a wide difference in the consumption of gasoline by the various engines submitted to the tests. This is naturally to be expected when the types of engines are considered. In the case of the Lewis and the Haynes and Apperson vehicles the cycle is such as to give an explosion every revolution, the pistons uncovering the exhaust ports. The exhaust from these engines was so densely carbon that a blast was required to drive the fumes from the testing room. This bears out the well-known theory that engines giving an explosion for every revolution, while possessing many advantages, have a very low economy, due to the improper combustion of the fuel supplied. The other motors were almost all operated on the Otto cycle. In the Benz type of motor the gasoline was thoroughly carburetted before being admitted to the cylinder, while in the Duryea the gasoline was vaporized directly at the cylinder; the results therefore enable a comparative opinion to be formed between these methods of using gasoline. It is to be regretted that owing to the disarrangement of the igniting mechanism on the Duryea engine, higher power tests were not possible. The Benz type of vehicle presents another interesting feature of comparison, being provided with but two ranges of speed, and in order to increase the range of control, when the engine is running at its normal speed, the supply and mixture of air and gasoline is varied. This is accomplished by a regulating valve controlled from the driver's seat. The explosive force of the mixture is readily controlled in this way, and a wide range of speed is thus given in the vehicle without the necessity for complicated mechanical devices for speed regulators.

Simplicity and ease of control may, however, be purchased at the expense of economy, as was apparent from the tests at various loads Under the best conditions of load a horse power can be produced at the rim of the wheel with almost one-fourth of the gasoline than it can under the worst conditions. With an engine such as the Duryea, where the speed of the engine remains constant and the regulator is affected by changeable gears, the economy with the variable speed of the vehicle is dependent entirely on the load carried by the engine Under some conditions it is therefore possible to ascend grades at the same speed as on level roads, with the same consumption of gasoline. In other words, the loading of the engine may so increase the efficiency that it will enable it to give the increased power without an increase in the consumption of gasoline.

The location of the driving engine and the method of transmitting the power to the driving mechanism greatly influence the amount of the vibration on the vehicle. Motors with two cylinders, having the cranks directly opposite each other on the shaft, greatly reduce the reaction. It would appear to be necessary to use more than one cylinder to eliminate vibrations in the vehicles when the engine is running and not propelling the vehicle. A number of tests were made of storage-battery motors, but as these are not adapted to general service on country roads, being dependent on charging stations and being very nearly double the weight of other highway vehicles, for the present they may be passed over. Experiments were also made on the resistance of the driving-wheels of the vehicles over different roads and obstructions.

The De la Vergne machine weighed 1,680 lbs.; the driving-wheels were 23.7 in. radius and the steering wheels 18 in., with solid rubber tires and roller bearings. The engine had one cylinder 5.12 in. in diameter, 6.62 in. stroke. The speed of the rim of the wheel, 1,000 feet per minute; pull exerted on rim, 51 lbs.; the horse power developed in cylinder, 2.07; gasoline consumed per hour, 4.45 lbs.; cost of 1 h.p. per hour, 5.66 cents at rim of wheel.

Duryea motor-wagon speed in feet per minute was 434 feet; pull exerted in pounds, 88.5; horse power at rim of wheel, 1.16; horse power exerted in cylinder, 1.75; pounds gasoline consumed per hour, 3.78; cost of gasoline per horse power per hour, 6.48 cents; heaviest pull exerted, 187 lbs.

R. W. Macey & Co., New York, Roger Benz motor's speed per minute was 945 feet; pull exerted, 87.2 pounds; cylinder 5 inches bore, 7 inches stroke, radius of driving wheels, 23.8 inches; steering wheels, 17.9 inches; solid rubber tires, roller bearings; weight of vehicle, 1,825 pounds; horse power developed in cylinder, 2.31 and 5.18; horse power exerted at rim of wheels, .83 and 2.50; gasoline consumed per hour, 3.22 and 4.90 pounds, do. per horse power per hour at rim of wheels, 3.90 and 1 96; cost of do. per horse power per hour, 3.92 cents and 7.80 cents; heaviest pull exerted, 103.7 pounds, belt slipping.

Mueller & Son's, Decatur, Ill., Benz motor's speed per minute was 540 feet; pull exerted is 92.1 pounds; diameter of cylinder, 5.5 inch; stroke, 6.25, horse power exerted in cylinder. 1.79; horse power at rim of wheels, 1.18; driving wheels at radius, 24 inches; steering wheels, 18.4 inches; heaviest pull exerted, 135.4 pounds; pounds of gasoline consumed per hour, 3.87 pounds, in horse power per hour at rim of wheels, 2.96 pounds; cost per horse power per hour at rim of wheel, 5.92 cents, total weight of vehicle, 1,636 pounds.

In the *Times-Herald* race, the Mueller-Benz moto-cycle travelled a distance of 92 miles over comparatively light roads from Jackson Park to Waukegan and return. The net running time was 8 hours and 44 minutes, and the gasoline consumed 31.52 pounds; this indicated a speed of 927 feet per minute, and a consumption of one pound of gasoline for 15,450 feet. In the tests shown, this machine at a speed of 984 feet per minute, and pull of 73.4 pounds, developed 1,268,000 feet pounds of work at the rim of the driving wheels per one pound of gasoline. Again, at a speed of 1,168 feet per minute, and a pull of only 34.7 pounds, it developed only 588,000 feet pounds. If the above development of energy were maintained, the average pull through the run would be 82 pounds, while the latter development would not be more than 38 pounds. It would, therefore, appear that resistance to propulsion is not a factor in economy of fuel, as with more work to be done, the gasoline develops a higher duty. An important factor in the economy of fuel consumption is involved in the control of the mixture of air and gasoline. It is quite evident that given two vehicles possessing equal merits as regards their control, then the one accomplishing certain results with the least cost of operation represents a lower annual cost than the other, and consequently a justifiable higher first cost, aside from the disadvantage of handling and storing oil. It seems paradoxical that the power and economy of oil-driven motors increases with the load put on them, but this has been demonstrated pretty clearly, and it remains now for scientists to investigate this matter thoroughly, and point out to those not so well versed in what direction they must move to get the highest potential from the oil or vapor.

NEW CREAMERIES AND CHEESE FACTORIES

The following new cheese and butter plants are awaiting contracts or will soon be at that stage.—

Aylmer, Que., is to have a creamery during the coming summer.——The *Victoria Commercial Journal* says a creamery will be established at Royal Oak, B.C.——The people at Lumsden, Assin., will build a creamery, according to the *Regina Leader*.——Landsdown, Ont., will probably compete in the manufacture of butter also this summer. Adam Beatty is moving in the proposed undertaking. —The Firby cheese factory, Corinth, near Aylmer, Ont., is the scene of organization of a local company to operate a creamery. Part of the capital has been subscribed.——At a meeting of farmers at Neepawa, near Portage la Prairie, Man., G. Hamilton proposed to build and run a creamery. The matter has not yet been decided.——The Bayham branch of the Brownsville Cheese Co., near Aylmer, Ont., is to have a new factory.——The shareholders of Cedar Grove cheese factory, Wallace, near Listowel, Ont., are arranging for a new cheese factory.——The farmers of Silver Creek, Ottawa Co., Que., are going to build a cheese factory, to be operated in conjunction with a number of others by Mr. Ross.

BUILDING CONTRACTS.

The building season, which will open in a month or so, will be a fairly busy one. The following new buildings are now awaiting contract, or will soon be so:—

A new wing to Galt Hospital, Galt, Ont., $5,000.——A large addition to the Rockwood Asylum, Kingston, Ont.— A group of buildings for the Gravenhurst, Ont., Sanitarium.——An eight-roomed stone building for a school in Kingston, Ont. —Residence, $60,000. G C. Boult, Hart's Island, River St Lawrence. ——Hospital, Portage la Prairie, Man——Normal College and Collegiate Institute, Credit Valley stone and pressed brick, to accommodate 1,000 pupils, Hamilton, Ont.——Lefebre Memorial Hall, to seat 900. St. Joseph's College, Memramcook, N.B.—— Three churches in Petrolia, Ont, aggregating $30,000.——English church, Listowel, Ont——Presbyterian church, New Glasgow, N.S.——Presbyterian church, Bathurst and South Sherbrooke, Dewitt's Corner, Lanark County, Ont.——Wall Street Methodist Church, Brockville, Ont, rebuilding and enlargement.—— St Mary's Roman Catholic Church, Winnipeg, Man., rebuilding and enlargement, $18,000.——Methodist Church, Havelock, Ont., $5,000.

——The Couchon block, Winnipeg, recently burnt, is to be rebuilt as residential flats, at a cost of $30,000.——The Presbyterians and also the Roman Catholics of Whitney, Ont., will build a church this summer.——Hawkesbury, Ont., will have a $30,000 church and Brockville a $10,000 school.——Smith & Bird, architects, Barrie, Ont., are asking for tenders for the erection of a Methodist church at Minesing, Ont.——The Presbyterian congregation at Napanee, Ont., have decided on expending $6,000 in improvements on their church.——A new Methodist church will shortly be built at Nobleton, Ont.——Plans are prepared for a $30,000 addition to the Deaf and Dumb Institute, Belleville, Ont.——Extensive impovements are to be made to St. Peter's Church in St. John, N.B.

LAKE OF THE WOODS GOLD FIELDS.

INTERVIEW WITH MR. R. H. AHN, M.E., GENERAL MANAGER OF THE DOMINION GOLD MINING AND REDUCTION COMPANY, LTD., OF LONDON, ENG.

"The Lake of the Woods gold field is very extensive, the latest geological map showing it to be about 100 miles wide by 500 miles long. Gold has been known to exist in the belt for many years, but owing to differences between the Manitoba and Ontario Governments it has been difficult until the last three or four years to obtain titles to properties. The mining interest in this field has suffered much for want of properly informed men. Most of the work done heretofore has been under supervisors who considered blasting for railway cuts a sufficient preparation for gold mining. This state of things is now changed, mining is being conducted on a more systematic basis, and the work now progressing is showing results which will be a revelation to most mining men. Many mines in other districts in operation at present are considered fair investments if they return a profit of a few cents per ounce of gold. This, however, is not the case in the Lake of the Woods district. Of the two mines in this district being worked now, one was but a grass root prospect last April. The purchase price of mine, plant, etc., has amounted to less than $50,000, and yet the weekly returns of bullion, as banked, show a profit of fully 100 per cent. per week. This is only one of many possibilities in that district, as it is likely that there are hundreds of mines as good as the one mentioned waiting to be opened up within this 500-mile belt. Another instance is the Sultana mine, which four years ago was purchased by a gentleman totally ignorant of mining, but who by perseverance has overcome the many difficulties which a novice would inevitably encounter. The output of this mine is now about $3,000 per week, with a ten-stamp mill, and employing not more than 60 men, whose wages average about $2 per day.

"Now that the reduction works have been put into such excellent condition, having a 20-stamp mill, a perfect system of vanners, and a complete sampling plant, lots of from one ton upwards can be properly tested; and it is the intention of the company who own these works to extend them this year by the addition of a chlorination plant for treating the concentrates of the district. The establishment of such works as these will be an untold boon to the country, because they afford an opportunity to anyone operating in the district of obtaining a treatment of their ore, and thus fully demonstrating the value of their property before undertaking the expense of erecting a mill for themselves. Precipitancy has been the cause of many failures already. Investors have been too anxious to obtain speedy returns on their original investment, and have rushed into the expense of erecting a mill before they had demonstrated that they had a mine. Such mistakes should now be a thing of the past, in this district at least, as anyone may, if he chooses, mine his ore right along.

"During my 20 years' experience in other mining camps, I have found that the mining fields which became famous owed their success almost invariably to opportunities afforded by the existence of customs mills. And I find the same thing eminently necessary in Canada. Would it not be wise for Canadian business men to give a little more attention to the development of the mineral resources of this country? More particularly when by so doing they could make far more money than is possible in the ordinary run of business. There are, I think, few manufacturing or mercantile businesses that are paying more than 5 or 10 per cent. on capital invested. Were the same amount of energy and careful business habits devoted to mining, the resulting benefit would be felt not only by those actively engaged, but by the country at large. Take one instance—copper Canada is importing more than $1,000,000 worth of this metal annually, while she has probably many hundreds of millions of dollars worth lying untouched in its native beds. This is but one of many instances in which Canada is ever impoverishing herself by sending out millions of cash to other countries, for those products which, by an ordinary amount of business enterprise, she might obtain within her own bounds. What is really required, and what will induce the influx of foreign capital, is primary development. Work some of the mining claims now lying idle and unprotected, so that there are bodies of ore in sight, and you may command all the foreign capital you want. There are to-day large numbers of inquiries coming to this country from monetary centres in all parts of Europe and America for developed mines, and not only thousands, but hundreds of thousands of dollars, would readily be found for the purchase of partly developed properties, when they actually show reasonable value for money. Why then will not Canadians turn their attention more to this branch, and by so doing, open their hands to receive the large amounts of capital really awaiting them."

Mr. Ahn shows a little bar of gold about three inches long, weighing 65 pennyweights, worth $63, and obtained from one ton of ore, at a cost of $10. He showed us also specimens of ore taken at depths of 40 and 70 feet, that from the greater depth being the richer in gold. The greatest depth yet reached is 260 feet. At this depth, the veins are showing themselves richer, wider and strictly free milling.

WHAT DOES ACETYLENE COST?

Editor CANADIAN ENGINEER:

SIR,—Can any of the numerous readers of THE ENGINEER inform the writer where an installation of acetylene gas can be seen in use, successfully lighting any town, village, factory, church or residence? It is now over seven years, in 1888, since it was discovered by Mr. Willson, yet the writer never read of its successful commercial and manufacturing use. Please say where this light can be seen, and what is the actual cost of it in contrast with electric light or gas. I am prepared to go a reasonable distance from home to see it when it is in constant use.

CANADA FIRST.

For THE CANADIAN ENGINEER.

STORAGE BATTERY TRACTION.

BY J. H KILLEY, HAMILTON.

In Paris, France, the Madeline and St. Denis road has now been in successful operation for three years, running 30 double-deck cars seating 60 persons. These cars up to two months ago have run 2,500,000 car miles. The service has been so efficient that there is a prospect that all the horse cars in Paris and its environs will be replaced by this system. Very good results have been brought about on these lines by recharging the batteries by the motor in the cars on all down grades. The cars when descending a ten per cent. grade, receive 50 per cent. of the energy back into the storage batteries on the cars, that has been expended on the up-grades. A corresponding amount is recovered on all lesser inclines; even in descending a 2 per cent. grade, 23 per cent. is returned. On a 1 per cent. grade this ceases. The batteries were formerly placed under the car seats, but they are now suspended under the bottom of the cars. The cars run 33 miles with one charge, this being made possible by the re-charging on down grade. The cars are braked in all positions by recharging the batteries.

The motors are shunt-wound and always used in multiple. The recharging of the batteries at the car house takes four hours, but they can be taken off the cars and replaced by charged ones in a few minutes.

In Germany one company during the last ten years installed 5,000 storage battery plants. In the Isle of Man the Snaefield Mountain line, with a 12 per cent. grade, rising 2,100 feet by a circular railway, is run by a storage battery. On this line the cars on the descending grade pick up 45 per cent. of the power used in going up the mountain. No brake is applied, the resistance of the motor in recharging the batteries being found sufficient for this purpose. In New York the Manhattan elevated railway is being changed from steam to storage battery traction, together with a third charged rail. They are now equipping the 34th-street branch with this system, and are sanguine that the result will be such as to justify them in thus equipping all their lines. They will have greater speed in starting with less expenditure of energy, less vibration on the line and cars, less annoyance from smoke, steam and sparks. There will be electric lights and head-lights on cars. The calculated saving in coal, labor, handling, etc., is $900,000 per year. There are many other city and suburban railways, both in Europe and the United States, run by storage battery. It is now allowed by well informed electrical engineers that this system of traction may supersede the trolley system in the near future, and do away to a great extent with the enormous leakages of potential that accompanies the trolley system of distribution.

THE MANUFACTURE OF WIRE CLOTH.

Few people have ever taken into consideration the important place which wire cloth occupies in present day civilization. One will not have to travel far in the contemplation of this subject without ascertaining that there is scarcely any article manufactured which is so indispensable as the fabric composed of wire in its different varieties. It is utilized in the mines and in the various mills for the screening, sifting and straining of the commodities produced. In the construction of locomotives, passenger coaches and palatial sleeping cars, wire cloth is largely employed, and so great has the demand become for the ordinary window screening that some large factories find sale for their output yearly of this article alone. The range of this material is also very great, and so perfect is the machinery now in use that heavy mining screens made of say 7-16 round iron, with a mesh measuring 3 inches, up to the infinitesimal 200 mesh to the lineal inch, is produced therewith. As may be expected, new uses for this article are constantly arising, the latest probably being that of a substitute for glass.

Whether or not the Ancients understood the art of weaving wire into cloth, may be open to question. Mention is made, however, of gold wires, which formed part of the embroidery of the garments of Aaron in the service of the Tabernacle. It is also certain that "sifting" grain by means of the "sieve" was a process known and employed from time immemorial.

A representative of THE CANADIAN ENGINEER, paying a visit the other day to the wire works of George B. Meadows, Toronto, noticed the latest development in the form of diaphonous wire cloth. By treating the cloth with a transparent composition a substitute for glass is formed, which is both tough and pliable. Though necessarily less transparent than glass, it can be used in many places where glass will not serve, and it will resist a good many acids, and will stand both cold and heat—its resistance to heat having limits, of course. One use to which it is being applied with great advantage is in the construction of interior partitions, fan lights, etc., the composition taking ornamental colors and being capable of forming handsome designs. No doubt other uses can be found for this kind of wire cloth.

HAMILTON IRON AND STEEL SMELTING WORKS.

(Correspondence of THE CANADIAN ENGINEER.)

A large number of citizens both of Toronto and Hamilton were invited by the smelting works' company to see a cast on the 8th February of about 20 tons of pig iron from the large blast furnace in the above works. The Toronto train arriving there at 2.30 p.m. brought in a contingent of visitors, who, with a large number of Hamiltonians, were taken from the Stuart street station to the works in passenger coaches drawn by the locomotive attached to the company's works. Altogether about 600 were present. The first point of interest visited was the powerful double steam hoists taking up the large amount of material required to keep the immense furnaces in operation. A number of visitors also went up with the hoist to the dizzy height, about 90 feet from the ground. After this the engine-room was visited, one of the ponderous 1,200 h.p. blowing engines being at work driving the air blast of 30 lbs. to the inch into the heating ovens, and from thence to the furnace. This splendid piece of mechanical work ran smoothly and noiselessly, and was very much admired by all the engineers who visited the work. After this the cast-house was the centre of attraction. As many of the visitors as could find room with safety were admitted into this building, in which were long lines of sand molds and a series of channels for the metal to be run through to fill these molds, after the style of water channels for irrigating purposes. The first work done was to tap the furnace at an elevation above the level of the molten iron to draw off the slag. This came out in a large volume, running like molten iron until it was all discharged. After this the clay plugs at the bottom of the furnace were with some labor removed, and the bright, nearly white, molten stream passed along the main channel, and was conducted into each group of molds by workmen with paddles covered with dry clay. The scene at this time was a very exhilarating one. When the metal was all discharged from the furnace the noise of the blast and the rear of flames that came through the aperture was deafening and seemed to scare a number of the onlookers. Before this could be stopped the great blast engines ceased working, and the workmen closed up the aperture, when the work of melting down the metal went on as before. The greater part of the visitors were taken to the Stuart station of the G.T.R. in two trains from the works, a large number of Toronto and Hamilton capitalists were among the visitors.

The whole of the capital required has now been subscribed. It stands at par, with plenty of enquiries for more shares. It is believed among those who have a knowledge of financial matters that in less than two months from now that the shares will sell at a premium.

It is the intention of the company that a new iron and steel rolling mill plant will be immediately put up. Negotiations are now under way for its purchase. It will be after the very latest designs for the manufacture of every kind of bar and plate iron and steel in general use in Canada. It is the intention of the company to put in a plant second to none, to make merchant iron from hammered puddled bar of the best quality. This, the iron ore now in use at the works is eminently capable of. A large number of men are now employed at the works. When the rolling mills and steel works are in operation the number will be more than doubled. All honor to the Canadians for finding the capital to complete the work that the original United States company were unable to do.

These works will not only be a lasting benefit to the city of Hamilton, but to the whole of Ontario, enabling the iron consumers to get a superior quality of both pig and merchant iron at home, and retaining the cost of production here, to the benefit of the workmen, merchants, farmers and traders of our own country.

Another correspondent writing on the projected new rolling mills in connection with the works, says: "The company intends to supplement the works with rolling mills; this will be almost a necessity, to make up the mill pig not suitable for foundries into wrought merchant iron by reheating and puddling it. By these means, and these only, can a first-class quality of merchant bar for general purposes be manufactured This, at present, cannot be made in Canada outside of Nova Scotia

The merchant iron rolled in Canada out of old steel rails, iron, old tubes, boiler plate, old ship plates, railway springs, discarded axles, and various kinds of used up and rejected iron imported here from Europe, when there is practically no demand for it, is rolled into iron and sold for general use. It, however, in no respect equals iron made from puddled bar direct from the pig. This every manufacturer knows often to his cost, as the iron made from mixed scrap, as done, is never regular in the grain, having hard and soft spots in it, and is reedy and open-grained. It would be better both for the proprietors of the mills, and those using their products, that a duty be placed on imported scrap to keep it out of the country, and to place the owners of the scrap rolling mills in a position to put in puddling furnaces, and so encourage iron mining and smelting in this country, where there are unlimited quantities of the best iron in the world lying quietly under the ground. This would be to the advantage not only of the mines and smelting works, but also to the mills now running on scrap, as they would turn out a much better quality of bar iron than they now do here; which would replace the large quantity now imported in consequence of the inferior quality of iron made from rolled steel and iron scrap. By this means they would secure the bonus given by the Dominion and Ontario Governments for iron manufactured from Canadian ores. This would be to their advantage, and do away with the fault found with re-heated and rolled iron by the present consumers, and lead to a still greater extension of blast furnaces in Canada, and retain a large portion of the money sent out of the country for bar iron, boiler and ship plates, channel and angle iron for bridges, etc., now imported principally from Belgium.

The smelting works and proposed rolling mills in Hamilton are a move in the right direction, and it is to be hoped that it may lead to the manufacture of all the iron required in Canada in the near future, as it has done in the United States. The protection given to the iron manufactures in the States has enabled them to make all the iron of every kind required for home consumption of a superior quality, and at a price to the consumer as low, or lower, than that made in any part of the world.

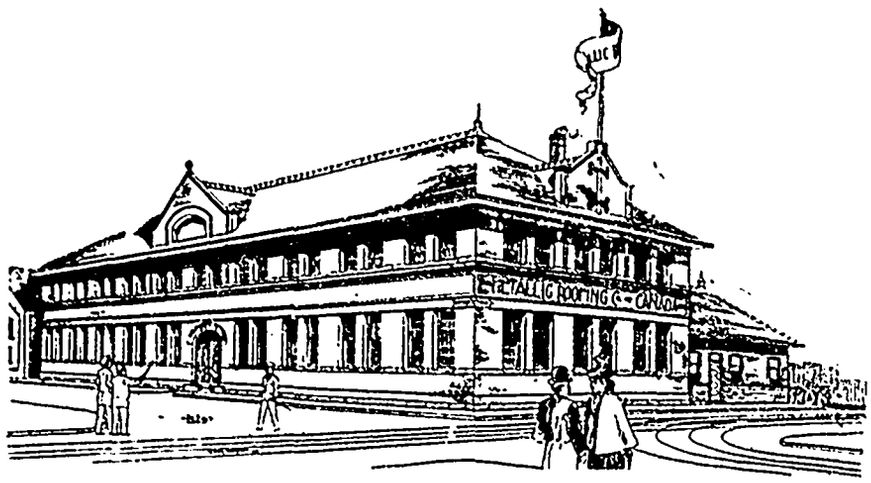
No country can reach a high state of civilization, and the prosperity that ought to be associated therewith, if it does not raise from the earth and manufacture its own metals and their products. This there is every opportunity of our doing in Canada, did we avail ourselves of our resources as we should.

CANADA FIRST.

METALLIC ROOFING COMPANY.

The new factory of the Metallic Roofing Co., corner of Dufferin and King streets, Toronto, referred to in a previous issue, is now about completed, and shows the progress made by this enterprising company. The main building, of which a sketch is here given, is 150 x 50 ft., built of hard pressed red brick laid in brown mortar, with cut brown stone coursing, window-sills, caps, etc., and is roofed with the "Empire" patent steel shingles, coated

with the company's new preservative, Coalite. At the rear of the main building, with a frontage of 50 feet on Dufferin street, there is an annex 150 feet long, substantially built of red brick, while adjoining the main building and fronting on King street, there is a handsome office building, 40 x 50 feet, which will be entirely



covered, both inside and out, with ornamental embossed steel plates of the company's manufacture. This building is separated from the factory by a new idea in ornamental fire-proof doors, which the company is just placing on the Canadian market The heavy machinery will be located on the ground floor, the ceiling of which is 16 feet high The shipping facilities and the general plan of the works are all that could be desired The company, while expending about $15,000 in new buildings, are reserving an additional block of land for future extensions.

TORONTO'S FUTURE WATER SUPPLY.

REPORT OF THE ENGLISH ENGINEER.

The anxiously looked-for report of James Mansergh, C.E., on the question of the water supply of Toronto, arrived on the 3rd inst., and forms an interesting volume of 88 pages, with four diagrams. Mr. Mansergh's fee of $15,000 was considered pretty high by the citizens; but it will prove, in the long run, to be a cheap and satisfactory investment. It has given the quietus to some illusory schemes that were being pressed upon the city council with a courage and persistency worthy of a better cause; and it has given the citizens and council cause for holding the opinions of their own city engineer in higher regard. Mr. Mansergh's report is, in the main, a straight endorsement of the advice given by Mr. Keating, ever since he was appointed city engineer of Toronto. It bears out also the opinions given by Mr. Keefer and other engineers, in the columns of THE CANADIAN ENGINEER, regarding the capabilities *of Lake Simcoe as a source of water and power supply for Toronto.*

After giving an account of his visit to Toronto and the neighboring field of his enquiry, Mr Mansergh goes to his subject by asking:

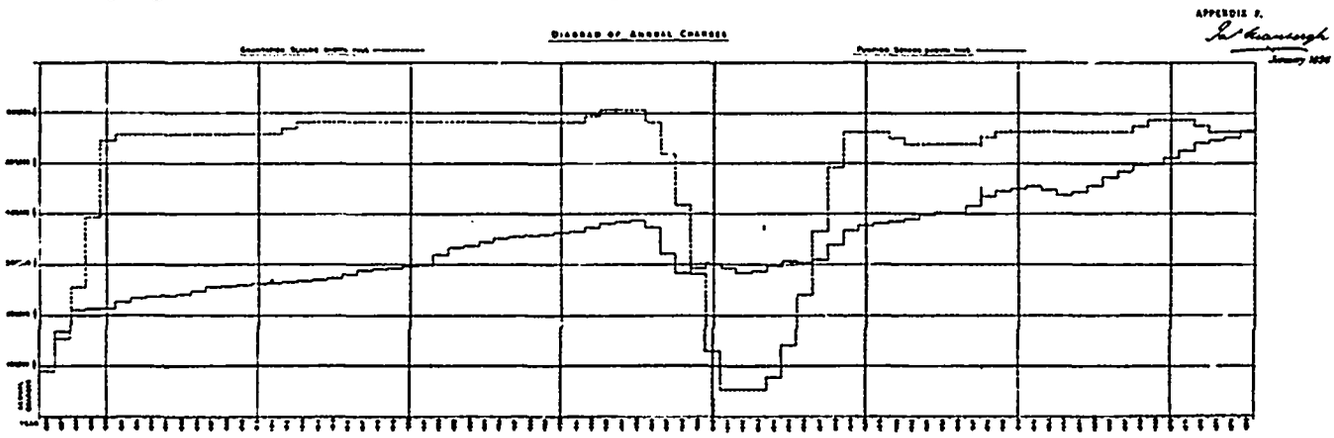
"What is to be in the future the source of the water supplied to the people of Toronto? The alternatives are:

1. Lake Ontario.... .....Pumping.
2. Lake Simcoe.... .....Gravitation.
3. Oak Ridge Lakes and Rivers Don and Rouge "

Other sources have been mentioned, and are referred to in Mr. Keating's report of October 30th, which I will describe as supplemental rather than alternative, because it cannot be contended that these sources would be adequate to provide the whole of the water required in Toronto for all time. These are. (a) Wells sunk in the gravel beds north of the city. (b) Springs and artesian wells in the township of Erin "

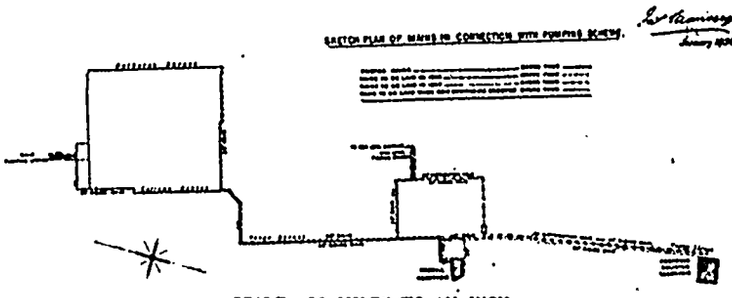
With regard to the wells sunk in the gravel beds, Messrs. O Brien and Gault, acting for the owners of the land, estimated that two million gallons per day could be delivered at a level of 200 feet above the Rosehill Reservoir, and at a price below that of water from any other source. The advocates of this source claimed that "the situation and the abundance of the water precludes the idea of its being a mere rain or natural drainage catchment." On this Mr. Mansergh observes: "I hope I may say without offence that it is a delusion, and that if the water is not the product of rain, but is supernaturally produced, then it is something of which I have had no prior experience, and am utterly incompetent to advise you about, but it surely will be time enough to investigate such a freak of nature when Lake Simcoe and Lake Ontario have failed." At best this could only be regarded as an auxiliary source of supply, affording one-tenth of the city's future needs, and is thus dismissed.

The Erin district he did not consider worth a visit. Mr. Keating describes having seen there three or four springs of bright and very hard water, issuing at an elevation of about 1,000 feet above Lake Ontario, and at a distance from the centre of the city, as the crow flies, of about 36 miles. The suggestion that this source might be available for Toronto seems to have come from a Mr. Vanderlip, who pointed out the site of an abandoned boring sunk some years ago with the hope of finding oil. At a depth of 80 or 90 feet water was struck and rose to the surface, but the search for oil having been unsuccessful the boring was abandoned, and its site is now marked only by a small puddle. Similar conditions might be discovered in any number of places around Toronto, and he agreed with Mr. Keating that the project of seeking water in so precarious a source, the bringing of which would involve the laying of a conduit nearly forty miles in length, could not seriously be entertained.



On the Oak Ridge lakes and Don and Rouge rivers schemes, reported on by Messrs. MacAlpine and Tully in 1887, and for which the estimate of cost was temptingly low, Mr. Mansergh noted a certain tone of apology in the recommendations of those engineers, who, after saying that the water was "pure and wholesome," admitted that it might need both chemical and mechanical filtration on account of the vegetable matter found in it. The analyst reported it to be "very impure and entirely unfit, in its present condition, for drinking purposes." Mr. Mansergh infers that the water of the two rivers is of the same character. The drainage area of these sources is set down at 151 square miles, and deducting one-half of

the annual rainfall (30 inches) for evaporation, he gets 15 inches as the amount that could be impounded, yielding 90,600,000 gallons a day, with a provision of 4,443,000,000 gallons for storage. This is not fifty times the daily quantity obtainable, while he would not think less than 200 days supply should be storable. He predicts that such a supply would fall in dry weather. The yield in summer might fall 15 cubic feet per minute per 1,000 acres for weeks together, which is equivalent to 821,000 gallons a day instead of the 12 or 15 million gallons estimated by Messrs. MacAlpine and Tully. He put the daily capabilities of these sources at 56,190,000, of which 33,975,000 per day would be derived from the flow of the rivers at 25 cubic feet per minute per square mile. Mr. Mansergh puts the cost of a 500-million gallon reservoir at $500,000, to which would be added $350,000 for the conduit and 15 per cent for



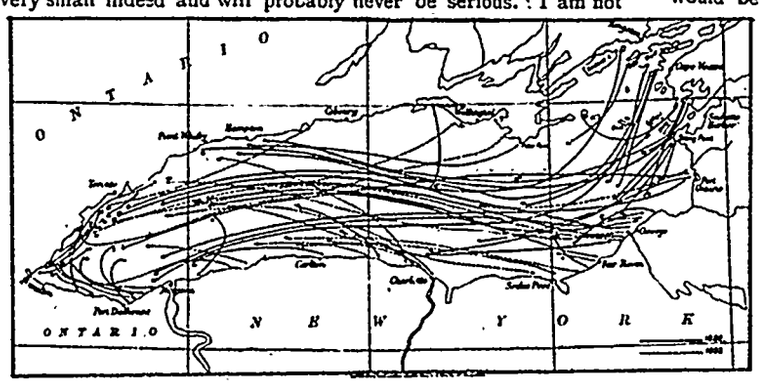
SCALE—12 MILES TO AN INCH.

engineering and contingencies, making $977,500, or nearly five times the estimate of MacAlpine and Tully. Instead of four to six months as the time of construction given by these gentlemen, he estimated nearly that many years. Further, if Toronto grew to the extent to require the water obtainable from these sources, the district would be so settled as to cause the pollution of the supply.

LAKE SIMCOE VS. LAKE ONTARIO.

Coming down to the real question—Is the future supply to be obtained by pumping from Lake Ontario or by gravitation from Lake Simcoe?—he says:—

"Curiously enough the two lakes we are dealing with stand, the one, Simcoe, at the head, and the other, Ontario, at the foot of the great system of inland seas occupying the centre of the North American continent; thus, on the water parting of the ridge between Simcoe and Ontario, a child with a toy spade could cause a little stream to flow either by a twenty miles' run into Ontario or to follow a course by way of Huron, Erie, and the Niagara River, of 800 miles. The water shed into Simcoe is 1,100 square miles and into Ontario 270,075. The average daily discharge from Simcoe by the River Severn is probably 660 million gallons; from Ontario by the St Lawrence 150,000 million gallons. The drainage area of Simcoe is sparsely populated, and the lake has upon its banks but a few small towns, so that the organic pollution is now very small indeed and will probably never be serious. I am not



in a position to say how the population of the rural part of the drainage area above Ontario compares ratably with that of Simcoe, but there are upon the banks of the great lakes a number of large cities and other populous places, and upon Ontario stands Toronto itself, which, from its proximity to the intake, I regard as more important by far than all the others put together. Making a broad mental comparison of these relative conditions, one would judge that, under normal circumstances of wind and weather, the waters of the two lakes should be very similar when viewed from a purely chemical standpoint, but Dr. Frankland advises me that the analyses show distinctly that the water of Simcoe is in this sense 'very decidedly inferior to that of Ontario.'

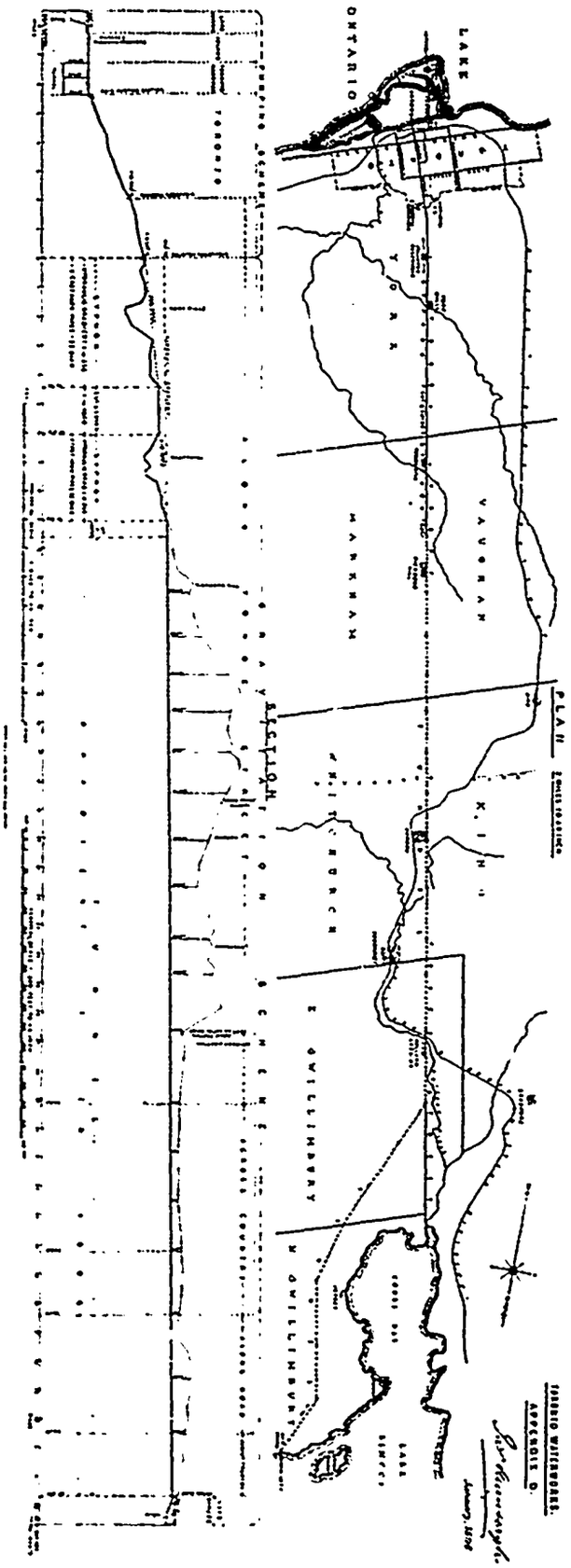
The bacteriological condition of water is, however, of greater consequence nowadays than its chemical composition, and in this respect under normal conditions he thinks there is nothing to choose between the two waters, and if he had not seen the result of an examination by Dr. Shuttleworth, he would have assumed that on the average Ontario water was slightly the better of the two. This water was taken in January, 1894, while a heavy sea was running and there was floating ice and abnormal disturbance. The number of organisms increased at this time from an average of 194 to 7,880. No doubt an enormous majority of these microbes were harmless (as is shown by the Royal Commission's report on London water in 1893), but Mr. Mansergh does not ignore the fact that for short periods of the year it would be inadvisable to send this water "into supply" in its raw state. Dr. Frankland says:—

"As regards filtration, I should strongly advise this to be adopted, whichever source is selected. If the water is not filtered, I should, on the whole, prefer Lake Simcoe; if it is decided to filter, then I should prefer Ontario." Mr. Mansergh thinks that the Simcoe water need not be filtered at present, but that at the outset it would be quite sufficient to construct a service reservoir to hold 100 million gallons, which should always be kept full (except in fire or other emergency), so that when the water was not quite right the city could be supplied from the reservoir for three or four days without drawing any from the lake. He adds: "If the Simcoe water is dealt with as I have just described, and if the Ontario water—drawn from the present intake—is filtered, both of them, as delivered to consumers, will be high-class waters of unimpeachable character, with practically nothing to choose between them."

Dealing with the question of cost, he takes the assessors' figures as a basis of estimating the growth of population, and starting with 175,000 as the population of 1895, he estimates that by 1945 Toronto will have 471,028 inhabitants. According to the records of 1894 the daily average consumption per head was 107.7 gallons—which, by the way, is a great deal more than in English towns, that of the metropolitan area of London being only 32.68 gallons per day per head, a difference which he attributes to waste or misuse in Toronto in common with most American cities. With a daily consumption of 13 to 25 gallons per head in some cities in Great Britain, he thinks that the consumption in Toronto should be brought down to 50 gallons, and the cost of providing self-registering water meters would soon be recouped. Assuming, however, that the consumption will go on at say 100 gallons per head per day, by 1945 it will amount to 47,102,800 gallons per day for the whole city, and in 1948 it will amount to about 50,000,000 gallons.

Taking the area of Lake Simcoe at 260 square miles—according to the map he used—and the watershed at 1,100 square miles, the collectible amount of water at 15 inches per annum, would produce a daily discharge at 660,000,000 gallons, and much more in wet years, so that there is no question about the sufficiency of the Lake Simcoe source. There is the question, however, of damages to those along the River Severn, whose riparian rights would be affected, but that might not be serious. If water were brought from Lake Simcoe, "the aqueduct in the lake would be a steel pipe laid in a dredged channel for some distance from the shore, and protected by substantial cribwork further out, where laid merely on the bed. At a very short distance south of the shore line, this pipe would connect in a proper penstock chamber or gate-house to the head of a brick and concrete aqueduct having its invert about 700 feet above sea level. Up to the penstock chamber from the lake, the work would be constructed in open cutting, but thenceforward it would be in tunnel. The section upon which I have laid down this tunnel was taken along Yonge street from Toronto to about two miles north of Holland Landing, thence in a north-easterly direction to near Jersey, and then north again to Lake Simcoe." In setting out this work, he would provide for a daily supply of one hundred gallons per head, to a population of half a million, but he does not go into the question of "providing power for all sorts of fanciful purposes," considering that it is "no part of the duty of a corporation to enter into speculations of this sort," and that it did not come under the scope of the enquiry for which he was engaged. This matter is, however, referred to later on. The tunnel would be lined with a composite of concrete and brick, having a curved invert, curved and battered sidewalks, and a segmental arch, its height being eight feet three inches, and its width at springing level seven feet. Its gradient would be 1 in 4,000, and its discharging capacity up to springing 5,660 cubic feet per minute, or nearly 51 million gallons per day. As set out on the section, the length of this tunnel would be 33 miles, its outlet end being situated about a mile and a-half south of Richmond Hill. At a point where the ground falls away,

a length of 5,000 yards of iron pipe would have to be put in to cross the valley. At present two 32-inch pipes would be needed to convey this water with a fall of 1 in 356, and two more would be required to convey the whole 50,000,000 gallons. At the end of the first syphon higher ground is reached, and a "cut and cover" conduit may be built almost as cheaply for the four pipes as two. Then the second syphon of 7,600 yards would begin, terminating in a new service reservoir near Eglinton, having its top level 300 feet above Lake Ontario.



SECTION COMPARING GRAVITATION AND PUMPING SCHEMES.

The original drawing is 27 inches, giving a horizontal scale of 2 miles to 1 inch, and a vertical of 303 feet to 1 inch. It is here reduced to 9 inches, giving 6 miles to an inch horizontally, and 900 feet to an inch vertically.

The estimate of cost of the gravitation scheme from Lake Simcoe is as follows:—Intake, $198,000; valve chamber, penstocks, screening apparatus, etc., and keeper's house, $17,500; tunnel (58,667 lin. yds.), $7,110,395; shafts on tunnel, $182,760; first cut and cover, $86,750; first syphon, $680,000; second cut and cover, $292,080; second syphon, $1,020,500; high service reservoir, to hold 100 million gallons, $500 000; provide for six houses, $12,000; mains to connect high service reservoir with Rosehill and distributing system in lower part of city, $335,000; contingencies, engineering, and supervision, 15 per cent., say, $1,565,015; total $12,000,000. Detailed tables are given showing how this expenditure would be incurred, and how it would be spread over the years to 1900.

Coming to the plan for pumping from Lake Ontario, it is apparent that while the Simcoe scheme cannot be done by instalments, but the greater part of the $12,000,000 would have to be provided at the outset, the cost of providing for a supply of 50,000,000 gals. a day by the pumping scheme from Lake Ontario could be spread over 49 years, instead of five, and the total cost would be less than half. But this difference is not all to the good, as the annual charges for pumping are comparatively heavy. If Mr. Keating's scheme were carried out the cost in 1896 would be $1,087,325; in 1897, $1,602,237, after which the cost in each year would vary from $221,375, the ordinary cost, to about half a million, according to the amount of additions to the plant; the total cost to 1944 amounting to $5,685,312. The amount for the tunnel under the Bay is put down at $486,000; the subsiding reservoir, $110,000; filter beds, $460,000 in 1896 and $500,000 in 1897, with $467,750 for various mains to be built this year and next. The total average cost of the water supply from 1896 to 1948 would be $3.96 per 1,000 gals. by the gravitation system, and $2.54 by the pumping system.

As a means of improving the present pumping system, Mr. Mansergh suggests that (1) the intake pipe be relaid on the lines suggested by Mr. Keating and already approved of by the city; (2) a small steam pumping station should be erected near the shore crib on the Island, to lift the water about seven feet into two subsiding tanks, to hold each eleven million gallons; (3) filter beds must be ultimately provided, but may be erected by degrees as may be deemed necessary by the City Engineer and Medical Health Officer; (4) the new pipes and tunnel to the pumping station projected by Mr. Keating must be carried out; (5) the compounding of the low duty engines, as proposed by Mr. Keating, should be done, and other extensions made as the demand increases; (6) rising mains must be laid to Rosehill and on to Eglinton when desired; (7) a new service reservoir must be constructed at Eglinton, with its top water at 300 feet above Lake Ontario, to hold 50,000,000 gallons; (8) as the new rising mains are laid the high level pumping station may be done away with.

Mr. Mansergh has a timely word to say on the sewage question, and condemns the present state of things by which the sewage of a city of 175,000 is discharged into a tideless and stagnant harbor. The urgency of this question is another reason for adopting Mr. Keating's plans, as the cost would not be so great that a plan of sewage disposal could not be carried out at the same time.

In another part of his report he characterizes the Simcoe power scheme as a will o'-the-wisp and a delusion, and shows that the gross power derived would be only 1,000 h.p., costing $84 per h.p. at Eglinton, or $151 delivered in Toronto, from the wires—more than twice the present cost by steam.

Mr. Mansergh's conclusions may be inferred from the foregoing, but in summing up he points out that in the future, by adopting the pumping system, the quantity used per head can be reduced 40 or 50 per cent., with corresponding reduction in running expenses.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

MONTREAL NO. 1.

During the month one new member was received, one rejected and one put back for a few weeks to enable him to brush up his memory on things technical. At the last meeting Gusset Stays was the subject under consideration, and was well handled by several of those present. On Thursday, March 12th, Bro. E. Valiquet will give a two hours' lecture on Vulgar Fractions and how to use them. We expect a full attendance, as everyone knows that Bro. Valiquet is master of this subject. We are in receipt of a copy of the new certificate of membership issued by the executive. It is indeed very handsome. Several of our members have already subscribed to it and I expect many more next meeting. At the last regular meeting the sad news of the loss sustained by Bro. W. F. Chapman, was announced by Bro. Elliotte, when the following resolution was unanimously carried. "The members of Montreal No. 1, C.A.S.E., in meeting assembled, having heard with deep

regret of the great and irreparable loss suffered by Bro. W. F. Chapman, president of Brockville No. 15, in the death of his beloved wife, do tender him our most heartfelt sympathy in this the time of man's greatest grief, and we do hope that some slight comfort may obtain in the thought that God who has called her for His own, will watch those who remain and give them strength to bear the great affliction."

B. ARCHIBALD YORK, Secretary.

The above is a reproduction, on a reduced scale, of the new certificate of membership of the C.A.S.E.

At the meeting of Toronto branch, C.A.S.E., on the 4th inst., John Fox, engineer at O'Keefe's brewery, read an interesting paper on the artificial production of ice. During the evening gold-headed canes were presented to James Huggett, engineer for the Freehold Loan Company, E. J. Phillip, engineer for T. Eaton & Co., and George Fowler, engineer at the Standard Woolen Mills, in recognition of their services in connection with the new hall on Victoria street.

At the last meeting of Kingston Branch, C.A.S.E., there was a large attendance, and some important matters were dealt with. A committee to act in concert with committees formed by other branches in Ontario was appointed to wait on the local member, Hon. Mr. Harty, requesting his aid in the passage of an act for the compulsory holding of certificates by all engineers. An insurance scheme has been successfully carried out, whereby members of this association receive a reduced rate of insurance on the dual plan of life and accident.

Some of the branches of the C.A.S.E have begun rather late in the day to move in the matter of the bill in the Ontario Legislature. The time to lay such plans is in the autumn, and they should be completed before Parliament opens.

The wives and daughters of members of Toronto No. 1, C.A.S.E., are holding a meeting at the residence of Mrs. Wickens, to consider a proposal made by that lady for having a "ladies' night," or "at home," at the new hall.

CANADIAN MARINE ENGINEERS' ASSOCIATION.

The marine engineers' annual "At Home," which was held in Forum Hall, Toronto, last month, was a success in every respect. Before the promenade commenced, a choice programme was rendered by the following artists: Miss Davis, Mrs. McFadden, G. T. Pendrith, T. C. Stewart and Miss Bessie Firdley. Carlile and Roberts, in the magic art, made lots of fun. Frond's orchestra furnished music for the dancing, which was kept up until the "wee sma' hours." An excellent supper was served by Ramsden & Lloyd, caterers. The hall was nicely decorated with bunting and flags from some of the ships wintering in Toronto. The proceeds of the entertainment were for the benefit of the widows and orphans of the engineers who lost their lives by the wreck of the steamer "Africa" last October.

JOHN MCDOUGALL, Montreal, has recently supplied the Montreal Cotton Company, Valleyfield, Que., with a Lancashire boiler 7 feet 6 inches diameter, and 30 feet long, Adamson patent flues, weight 18 tons. This is the second one they have made for the company, having put in one a year ago. They have on hand orders for another Lancashire boiler, 7 feet diameter and 28 feet long, three tubulars 6 feet diameter and 16 feet long, and have just completed 4 tubulars 5 feet 6 inches diameter, 16 feet long.

FIRES OF THE MONTH.

Feb. 7th.—George Hawkins' glue factory, Port Hope, Ont.; $3,000 damages.——Feb. 8th.—M. Zwicker's sawmill at Wallace Lake, Bear River, N.S.; engines and boiler saved; loss, $1,000.——Feb. 10th.—Campbell & McNab's roller mill, Douglas, Renfrew county, Ont.; $8,000.——Feb. 14th.—McMillan's steam sawmill, North Sydney, C.B.; $10,000. ——Feb. 19th.—The Riordan paper mills, Merritton, Ont.; storehouse damaged, $4,000.——Feb. 18th.—Baldwin's sawmill, Ross & Keene, near Lake Megantic, Que.——Feb. 22nd.—Freight shed B. & A. Railway, Blanchard, N.B., freight destroyed; all insured.——Feb. 26th.—J. W. Drake, furniture factory, Windsor, Ont.; $4,000.——Feb. 26th.—Moore Bros.' oil mills, engine, derrick, tanks, etc.; $800. ——Feb 28th.—The chemical laboratory of the Ontario Agricultural College, Guelph, Ont., $9,000.

Industrial Notes.

BROWN'S foundry, Tilbury, Ont., is being enlarged.

MILNER Carriage Works, Chatham, Ont., are being enlarged

CITIZENS of Westport, Ont., are desirous of buying a fire-engine.

F. ROUTHIER & SON, foundry, Vankleek Hill, Ont., have assigned.

OTTAWA will spend $2,000 on expert advice on the drainage question.

W. HIBBARD'S new saw-mill, Granby, Que., is ready for operation.

THERE is a good deal said about a canning factory for Smith's Falls, Ont.

H. HARDY, Little York, P.E.I., is building a saw-mill adjoining his grist-mill.

CAMPBELL BROS., hardware, Winnipeg, in business since 1880, have assigned.

THE town council of Perth, Ont., will probably buy a stone-crusher at once.

C. HILL'S chair factory at Wiarton, Ont., will be running by 1st July, it is said.

GALT, ONT., is to retain the services of A. J. McPherson as resident engineer.

THE machinery in the beet sugar factory in Granby, Que., is to be sold, it is reported.

ONE of Rhodes-Curry's Company's factories has closed down for some weeks for repairs.

A NEW lobster factory is building on Grand Manan, N.B. H. H. Cole is manager.

THE city council of St. John, N.B., is reviving the St. John-Carleton bridge scheme.

THE paper mill being built by H. M. Hart, at Hillsborough, N.S., is nearing completion.

CARBERRY, MAN., council is taking action towards providing fire protection for the town.

HARTLAND, N.B., will have a new wood working factory. R. W. Richardson is building it.

THE ratepayers of Barrie, Ont., have decided by 161 majority to own their own waterworks.

SHERBROOKE, QUE., is determined to obtain a new drill shed from the Dominion Government.

NAPANEE, ONT., will have a new sash and door factory. The old Crouch factory is to be equipped

THE Blaisdell Paper Pencil Co., Quebec, has been granted a Dominion charter. Capital, $50,000.

THE Welland Vale Bicycle Works, St. Catharines, Ont., is being enlarged at an expense of $8,000.

RICHARD THOMAS will manufacture his windmills in Aylmer, Ont., in future, instead of Harrietsville.

THE New Barns Cycle Co., Woodstock, Ont., is asking for a charter to manufacture and deal in bicycles.

THE city of Sherbrooke paid over the bonus of $30,000 to the Jenckes Machine Co., on the 12th February.

THE Jas. Smart Manufacturing Co., Brockville, recently turned out a casting weighing a couple of tons.

A LARGE flour warehouse, wharf, and freight shed will be built by the C.P.R. at Fort William, Ont., at once.

E. LEONARD & SONS, London, Ont., have supplied R. Hoey, Hardingville, N.B., with a portable saw-mill plant.

HEIDERMANN & TRACHSEL will rebuild their flax mill, near Shakespeare, Ont., which was burned down recently.

THE Hub, Spoke and Bent Goods Manufacturing Company, of Sarnia, Ont., has been incorporated; capital $50,000.

THE people of Fort William, Ont., are considering the advisability of bonusing a flour mill to the extent of $50,000

KENTVILLE, N.S., has a carriage factory, the Nova Scotia Carriage Works, which has been got up by local capitalists.

R. C. TAIT, Shediac, N.B., and J. & T. Jardine, Kingston, N.B., are putting in new engines by E Leonard & Sons.

THE St. Thomas Mfg. Co (Williams & Simpson), St. Thomas, Ont., wire mattresses, etc., are removing to London, Ont.

AYLMER, QUE., has advocates for the establishment of a Government cartridge factory in the old court house there.

THE Ingersoll Rock Drill Company is now being carried on by James Cooper as the Ingersoll-Sergeant Drill Department.

THE Howey saw mills, Fenelon Falls, Ont., are being enlarged. The box factory in the same town is working day and night.

BROWN & RUTHERFORD, Winnipeg, Man., are running their saw and planing mills again, after a shut-down of some months.

ROBT. MITCHELL & Co., Montreal, brass finishers and metal workers, are applying for a Dominion charter. Capital, $200,000.

THE people of Aylmer are in danger of losing their canning factory, but Hamilton is to have a new one, say D. Marshall & Co.

COOKE & SON, St. Catharines, Ont., have the contract for an $8,000 addition to the Welland Vale bicycle factory, St. Catharines.

J. & H. TAYLOR, Montreal, are to become a Dominion corporation, under the name of the Taylor Iron and Steel Co. Capital, $30,000.

THE Leamington Beet Sugar Co. is so far on its way as to apply for a charter to carry on business, and accept bonuses and exemptions.

G. E. SMITH, Montreal, has invented a machine for curving railway rails. Any degree of curve required can be obtained by this machine.

THE Acadia Sugar Refining Company has ordered two 60 horse-power Robb-Armstrong engines for the Woodside and Nova Scotia refineries.

EDWARD HARNETT is removing his steam saw mill from St. Louis, Kent Co., N.B., to Sussex, where he is under contract to do ten years' sawing.

OTTAWA City is asking the Ontario Government for leave to expend $125,000 on its waterworks, without receiving the consent of the ratepayers.

PEUCHEN & Co., acid and paint manufacturers, Toronto, are negotiating with the town of Lindsay, Ont., for inducements to locate in that town.

COWAN & Co., wholesale hardware, London, Ont., are offering 50 cents on the dollar. R. Dennis, wire works, in the same city, is making a like offer.

IT is said that an iron bridge is to be built across the Bonnechere River, somewhere between Bonnechere Point and Renfrew, Ont., in the near future.

WOODS BROS. Tire Company, Kingston, Ont., are reported to have received $5,000 for the right to manufacture their leather bicycle tires in England.

THE Imperial Mail Marking Machine Company, Montreal, is going to be incorporated, H. S. Holt and others, provisional directors. Capital, $500,000.

THE Booth Copper Company, Limited, Toronto, is the name under which Geo. Booth and others desire to carry on business with a capital of $25,000.

AN attempt is being made by D. P. Kent and others to secure a water supply for Fredericton, N.B., by putting down artesian wells on a neighboring hill.

IT is said that another pulp mill will be started in Digby county, N.S. The people interested are said to have bought the Bennet property on the Sissibbo River.

THE plans for a water supply for Renfrew, Ont., prepared by Alex. Potter, C.E., New York, are for a gravitation supply from Hurd Lake, at a cost of $65,707.

THE Canadian Cold Storage Company, Ltd., has been incorporated in Nova Scotia. G. E Boak, W. Clark, T. Ritchie, J. W. Biglow, Wolfville, are incorporators.

THE estimate for a sewerage system for Fredericton, N.B., prepared by Willis Chipman, C.E., Toronto, is $80,000 for eight miles of pipe to serve a population of 15,000.

THE Carleton Place, Ont., town council is making money by renting the services of their stone-crusher to outsiders. Other towns promise to follow suit in this new industry.

THE West Coast Packing and Trading Co., R V Winch (Vancouver, B.C.), manager, are proceeding with the building of their cannery at Nootka Sound, Vancouver Island, B.C.

THE *Sherbrooke Examiner* reports that on the 27th Feb., Norman McKay was seriously injured by the bursting of the cylinder of the engine in Levi Judd's saw mill in Spaulding.

A. E RICHARDS and others are applying for incorporation as the Selkirk Transportation and Cold Storage Co., to deal in fish and transport freight and passengers on Lake Winnipeg.

"THE Dominion Car Axle Lubricating Company," Windsor, Ont., is applying for Dominion incorporation; J. B. Wright and others, Detroit, provisional directors. Capital, $50,000.

THE contract for the stone work in the new steel bridge on the Trout River, between the townships of Elgin and Godmanchester, Huntington Co., Que., has been let to J. Tallon for $1,090.

THE New Glasgow Milling Co.'s flour mills, in New Glasgow, N.S., which were fitted up entirely by a Toronto firm, are now running, and the machinery is giving complete satisfaction.

THE Cape Sable Packing Co., Ltd., Yarmouth, N.S., is an applicant for incorporation in Nova Scotia; capital, $8,000. Provisional directors: T. S. Poole, A. H. Poole and N. C. Poole.

AT the annual meeting of the Peterboro' Lock Mfg. Co. the old board of directors was re-elected. At a subsequent meeting it was decided to put up new buildings, and tenders are called for.

THE C.P.R. is bringing dressed lumber in from British Columbia for use in its car shops. This takes work out of the hands of the local shops, but of course aids in developing British Columbia.

THE contract for extending the breakwater at Souris, P.E.I., has been let to Heney & Smith, Ottawa, at $27,800. A further sum of $15,000 is to be expended in days' work in repairing the inner portion.

THE proceedings against Edgecombe & Son, who tendered for the carriage factory and stock of Kelly & Murphy, St. John, N.B., insolvent, to oblige them to carry out their tender, have been dropped.

THE aldermen of Kingston, Ont., feel confident that the Dominion Government will grant their prayer for a new drill hall, but promises of favorable consideration are notoriously poor building material.

THE Goldie-McCulloch Co. has received an order for two Wheelock engines from St. Hyacinthe, Que., and is also filling an order for an engine from the Standard Shirt Company, of Montreal.

THE Burnstown and White Lak. bridge, over the Madawaska River, Renfrew Co., Ont., is in need of repairs, and a number of the ratepayers are anxious to have an iron bridge if it did not cost too much.

AN acetylene gas plant to light up Whiten & Stewart's photograph gallery in Orillia, Ont., is being made by Frank Muredrell, of Woodstock, Ont. Thomas Haywood will also use the gas in his grocery store.

THE Ontario Board of Health, at a recent meeting, approved of the plans for the extension of the sewage system of the town of Welland, and also in Galt. The plan of the water works in Cardinal was also approved.

THE Collingwood *Bulletin* says the Committee of the Town Council on Industries is considering the application of Worthington & Son, Toronto, for an inducement to establish a foundry and machine shop in that town.

SPEAKING of bonuses, the proprietor of a leading Kingston, Ont., hotel wants to know why he should not have one, and the *Whig* remarks that it pays $16,000 a year in wages itself and wants to come in too. So does everyone.

THE Westville Foundry and Machine Company, Ltd., Westville, Pictou County, N.S., is a new maritime province enterprise. The provisional directors are: G. E. Munro, R. A. McDonald, M. McLeod, J. McLeod, and H. R. Munro.

THE Maritime Ironfounders' Association has been organized. The officers are: Joshua Peters, president; Joshua Smith, vice-president; W. S. Fisher, secretary. A meeting for further organization will be held in St. John, May 26th.

THE people of West Kootenay, B.C., are subscribing stock to aid the B.C. Iron Works Co., Vancouver, B.C., in establishing a branch in that town. The town has given a grant of a site and the people have subscribed the amount asked.

H. MATTULLATH, of New York, N. H. Stevens, H. Malcolmson, M. Campbell, F. B. Stevens, G. B. Douglas, and J. A. Walker, of Chatham, are applying for incorporation as the "Ontario Safety Elevator Company, Ltd."; capital, $300,000.

THE bursting of the fly-wheel in the Coldbrook Rolling Mills, St. John, N.B., on Feb 12th, caused $2,000 damages, and injured the engineer, John O Brien, so seriously that he has since died; a number of workmen had very narrow escapes.

THE Elgin and Middlesex county councils met recently in St. Thomas, Ont., and awarded the new Belmont bridge to the Central Bridge and Engineering Co., Peterboro, Ont.; Geo. Ponsford, St. Thomas, got the contract for the concrete abutments.

GEO. LONG, manufacturer of sashes and doors, Sherbrooke, Que., applies to the city council for a bonus, as he is about to build large new premises and finds that the city regulations compel him to employ brick in his buildings, which involves an additional outlay of nearly $300 per annum.

THE Maritime Nail Works, St. John, N.B., are now running nine wire nail-making machines and seven more are to be put in. Machinery for the manufacture of horse nails and tacks will be introduced as soon as the full complement of wire-nail machines is in position. The output is now 80 kegs a day.

A BOILER explosion wrecked the Moore & Wallace sash and door factory, at Chesley, Ont. The building was torn to pieces and parts of the boiler were found 100 yards away. As the building was empty at the moment, no lives were lost. The freezing of the feed-pipe is thought to have been the cause.

HORSELESS vehicles are coming in for a good deal of discussion in British Columbia, where experiments are being made with traction engines by mine owners, as it is thought they will be cheaper and better than animals, and in many mining districts railways are not to be thought of. A great deal of opposition is made to their use by horse owners.

D. A. MCKENZIE & COMPANY, trading under the name of the Toronto Varnish Works, 400 Eastern avenue, have offered their creditors 33⅓ cents on the dollar, and an assignment of the estate will be asked for. The liabilities are $10,000, and the assets are $24,000, of which $13,000 is in real estate. Mrs. McKenzie has a claim of $5,000 against the business.

AT a recent meeting of the council of Huntington, Que., J. C. Vanier, C.E., Montreal, submitted estimates for the water supply of the town. Gravitation, steam pumping with stand pipe, water-power pumping, and combined wind and steam pumping were estimated at $53,172, $33,139, $37,604, $30,601, respectively. Mr. Vanier recommended the combined wind and steam-pumping system.

R. G LECKIE is seeking some amendments to the charter of his coal and railway company. He says he expects to begin the erection of smelting works in Carleton early in the spring. They are expected to cost about $75,000, and will take about a year to construct. The construction of the railroad from the Grand Lake coal fields to Fredericton will also be commenced in the spring.

AT the annual meeting of the Londonderry Iron Company, Limited, Acadia Mines, N.S., the old board of directors were re-elected, viz.: A. T. Paterson, president and managing director; Jas. Phymister, secretary; F. C. Budden, treasurer. Board of management, Lord Mount Stephen, Sir Charles Tennant, A. S. McClelland, J. N. Greenshields, A. T. Paterson, John Turnbull and R. MacD. Paterson.

THE Mechanics' Supply Co., Quebec, keep a full line of brass work, and as they are agents for such reliable houses as the J. L. Morrison Brass Manufacturing Co., Penberthy Injector Co., Jenkins Bros., Garth & Co. and others, their goods are of the highest order, and as they carry a large supply in stock, they can promise prompt shipments. Send for their illustrated sheet "G," which shows many of these goods.

R. C. ELDRIDGE and Alex. Fraser are in town on matters connected with the new metal works. These works will be pushed to completion, and material is being placed and work done preparatory to the rush that will be made when the winter breaks. The promoters say that the machinery will be revolving before the end of June—and they are men who generally say what they mean and mean what they say.—*Welland Tribune.*

THE Gardner Tool Co., which is applying for incorporation with capital of $100,000, of Brockville, Ont., has bought the Beaver Saw Works, Hamilton, Ont., and removed them to Sherbrooke, Que., where they will be operated by the G.T.C. The Brockville business will be continued as heretofore. Sherbrooke grants a bonus of $5,000, a free site and exemption from taxes for twenty years. The Co. agrees to pay $40,000 a year in wages in Sherbrooke.

THE Clappison Pipe and Boiler Covering Co., Hamilton, Ont., have recently applied their asbestos magnesia sectional covering to the pipes, etc., for the following concerns: Guelph Norway Iron and Steel Co.'s rolling mill, Guelph; Hamilton Iron and Steel Co.'s smelting works, Hamilton; H. A. Lozier & Co.'s bicycle factory, Toronto Junction; London Electric Co., Ltd., lighting station, London; Carling Brewing and Malting Co.'s brewery, London; Parisian Steam Laundry, London, London and Petrolia Barrel Co., London, Joseph E. Seagram's distillery, Waterloo, Consumers' Gas Co., Waterloo; and Newlands & Co.'s woolen mill, Galt, besides many other smaller contracts.

IN January the town of Niagara Falls, Ontario, passed a by-law to raise $109,000 for a general sewerage system. This work is being proceeded with immediately, and about half will be completed during the present year. The notable features of the work will be the large amount of rock excavation and the construction of trunk outlets over the cliff and into the Niagara River gorge. There will be three outlets upon the present design, the largest of which will be beneath the cantilever bridge and immediately above the Whirlpool Rapids. General plans for the system are completed, but details and specifications are not yet prepared. Construction will be pushed as soon as spring opens.

THE catalogue issued by the Canadian Office and School Furniture Co., Limited, of Preston, Ont., shows that company to be keeping in the van in their line, in Canada. Some of their new styles of desks comprise almost every conceivable point of utility, with elegance of design and finish. It is very gratifying to know that the company have had a steady increase in the foreign trade established by them at the time of the Colonial Exhibition, in London, and Canadian desks are known now almost to the ends of the earth. One of the specialties in which this company have achieved great success is the manufacture of interior work, such as panneling, railings and decorations for offices and houses.

ON February 26th a frightful accident took place at the shop of Nicholas Consigny, in St. Joseph street, in St. Roch's ward, Quebec, by which one man was instantly killed and another received such injuries that his life is in danger. It seems that the brothers, Nicholas and Arsene Consigny, who are machinists, were experimenting with acids for the manufacture of acetylene gas, and had just loaded a quarter-inch iron pipe with gas fluid, when it exploded with great force. The pipe was in a tub of water, when it was found to be leaking, and Arsene, without paying any attention to the gauge, lifted the pipe for the purpose of locating the trouble, when the explosion took place. The gas fluid struck him with great force in the right eye, and penetrated the brain. He dropped dead on the spot. In doing so he came into contact with his brother

Nicholas, striking him on the head with great violence. Nicholas also received a very severe shock from the escaping gas, and his injuries may prove fatal. The deceased leaves a family of four children. The coroner will hold an inquest.

At the annual meeting of the Pictou Charcoal Iron Company, New Glasgow, N.S., it was decided that the profits of last year's business should be spent in putting in two new puddling furnaces, steam hammer and rolls. The following directors were elected: A. C. Macdonald, president; H. M. Fitzpatrick, W. B Morse, J. D. McGregor and Major Markham.

M. Beatty & Sons, Welland, Ont., have shipped machinery to equip a Boom dredge for W. D. Benson, New Westminster, B.C. It will be used in building dykes on the Fraser River, near New Westminster. The firm is also equipping a dredge for the Quesnelle Mining Company, which will be used to dredge the gold-bearing sand from the bed of the Fraser River.

P. A. Rhodes, Inspector of Fire Appliances for the mutual insurance companies, Boston, Mass., gave the Knowles Fire Underwriter Steam Pump at the Canadian Rubber Company, Montreal, a severe test as follows: Size of pump, 18, 10, 12; capacity, 1,000 gallons per minute In testing the pump he connected two 50-foot lengths of 2½ hose on to the pump, and ran the pump at 80 pounds pressure from open ends, no nozzles being used. The pump in this test discharged over 1,200 gallons per minute. Second test closed up all valves, and run the pump under a water pressure of 150 pounds, when pump discharged all water through the relief valve Mr Rhodes expressed himself as fully satisfied with the working of the pump. When running at the utmost speed possible there was no vibration or jar. The pump, hydrants, pipe, etc., were put in by R. H. Buchanan & Co., Canadian agents for the Knowles & Blake Steam Pump Company, of New York.

Wm. Kennedy & Sons, Owen Sound, Ont., are applying for incorporation as a joint-stock company. Since the 15th May last the firm has turned out of their shops to order thirty-seven new American turbine water wheels, which are capable of developing 11,144 horse power under the respective heads of water under which they are placed. Four of these wheels weigh over forty-two tons, and the total weight of the thirty-seven mentioned turbines is very nearly two hundred and forty-two tons. A few days ago the Hull Electric Co., of Ottawa, awarded to Messrs W. Kennedy & Sons a contract for five of the largest size "New American" water-wheels, together with the upright shafts, gearing, "jack" shafts, iron bridge-trees, large pulleys, etc., for installation at Deschenes Que., on the Ottawa River, a short distance above Ottawa city These wheels are to be used to develop power to drive the generators and dynamos in the new power-house of the above company, for the purpose of operating the Alymer branch of the C.P.R. by electricity, electric lighting at Alymer and Hull, etc. The contract was awarded to the firm without competition, which speaks well for the estimation in which they are held, and for the quality and price of the work which they turn out. Everything is to be first-class.

Electric Flashes.

It is said that St. John's, Nfld., is to have an electric street railway.

The Royal Electric Co. are extending their premises on York st., Toronto.

St. Thomas, Ont., is opposed to the building of an electric road from London to Port Stanley

Geo. Sleeman, of Guelph, Ont., will build another mile of the electric road in that town before May 20th.

Haley Bros. & Co., St John, N.B., are having a 50-light incandescent dynamo installed in their factory.

It is reported that the Bear River, N.S., Electric Co. are to extend the Bear River light system to Digby, N.S.

Halifax, N.S., has its electric street railway in operation. A number of minor accidents marked the advent of the trolley.

Hon. Jno. Haggart announces that the Dominion Government will leave electric railways to provincial control in future.

A committee of the town council of Arnprior, Ont., will deliberate on the purchase by the town of the electric plant there.

A cylinder head in the power house of the St. John Railway blew up recently and paralyzed the light and power plant for some time.

The Petrolea Light, Heat and Power Company have recently put in a Goldie & McCulloch 125 h p boiler and a Northey condenser.

The *Grey Review* says that J H. Kilmer has secured enough subscribers in Durham to justify him in putting in an electric lighting plant.

The Thorold, Ont, street railway is to be practically rebuilt this spring The trolley system will be put in, and the line laid with T rails.

Surveys are being made for the new line of the Montreal Park and Island Railway from the big bridge at Back River to St. Vincent de Paul.

The council of Niagara Falls is considering the proposed electric street car franchise which the N.F., W.P. & C. Tramway Company asks for.

The town council of Newmarket, Ont., has decided to raise $9,000 by way of loan to operate an electric light plant, which will belong to the town.

A Pakenham, Ont., gentleman who has gone into the electric light business, is contemplating the extension of his system to Arnprior, says an exchange.

H J Beemer is making arrangements with some capitalists from the United States for the immediate pushing of work on the new Quebec electric railway.

Rhodes, Curry & Co., Ltd., Amherst, N.S., have just turned out the first two of the fourteen street cars they are building for the Halifax Electric Street Railway.

It is said that the International Radial Railway Co. has decided upon a route from Hamilton to Freelton and Guelph. Both Waterdown and Dundas will be given the go-by.

The Hamilton and Dundas Railway Co. is desirous of changing from steam to electric traction, but fears to lose its Sunday trains by thus placing itself under the Ontario Act.

W. H. Fredenburg will put in an electric light plant in Westport, Leeds county, Ont., provided the town will guarantee him two hundred lights at two and a-half cents per light.

The planing mill owned by McIntyre, Reinke & Bowland, Eganville, Ont., has started operations, electricity being the driving power. The business will undoubtedly prove a success.

The city council of Kingston, Ont., are in favor of municipal ownership of lighting plants, as the replies to the enquiries sent out by them to cities all over the continent point in that direction.

Some of the Campbellford, Ont., people are trying to organize a company to build an electric road from Campbellford through Warkworth and Hastings to Norwood, and return by Havelock.

The promoters of the electric railway between Perth and Lanark, who have been voted $10,000 by the village of Lanark, intend asking Perth council to submit a by-law for $5,000 bonus.

An action for $5,000 damages has been taken by J. Dowar against the Montreal Street Railway Company for injuries caused by a street car running into a cart in which plaintiff was driving.

The city council at St. Thomas has decided to submit a by-law to the ratepayers for the issue of debentures to build a street lighting and commercial electric light plant, at an estimated cost of $50,000.

J. Barrett, of Toronto, is asking permission to erect poles and wires for the purpose of transmitting power and light throughout the township of York. The electricity will be generated at the Humber.

The following are the directors of the Hamilton Street Railway Company: B. E. Charlton, president; George E. Tuckett, E. Martin, Q C., W. Gibson, M.P., J. B. Griffith, William Harris and F. W. Fearman.

The Canadian Electric Light Co. have a gang of men at work putting up the poles in connection with the electric lights for Tavistock, Ont. The dynamo is to have its seat at the Tavistock woolen mills of J. G. Field.

E. Leonard & Sons, of London, Ont., recently bought the electric light plant of the Grand Central Hotel, St Thomas, Ont., for $520. The plant consists of engine, boiler, dynamo, poles and wires, and originally cost about $2,500.

W. Dale Harris, general manager of the P.P.J. Railway, says that if the C.P.R. sell their Alymer branch to the Hull Electric Co., the P.P.J. Railway will this summer build a line from Alymer to Hull, and that the extension of the O. & G. Railway from Wright to Desert will also go on this summer.

THE Victoria, B.C., Electric Railway is to be sold at auction on April 11th, if not sold earlier by private sale by the bondholders. It is expected that they will buy in the road themselves and run it. The prospects for the unsecured creditors are not bright.

BY-LAWS to allow the Trenton Electric Co. to erect poles and string wires between Belleville and Trenton, and one to allow the Belleville Traction Co. permission to extend their street railway from the city to the cemetery, were recently adopted by Belleville council.

THE town council of Lachine, Que., will allow the Montreal Park & Island Railway running privileges in the town, with exemption from taxation for thirty years. It is contemplated to build this line at once, and to extend the Outremont line to St. Laurent during the summer.

IF the city council of New Westminster, B.C., will grant a bonus of $50,000, the Consolidated Railway and Light Company will build an electric railway from Westminster to Steveston, with a branch to Sapperton, and locate the central offices and repair shops in New Westminster.

JOHN MCGILL, JR., of Thorold, Ont., has invented an ingenious and useful device to save electric light wires from breaking at the poles, where the swinging and weight of the lamps frequently cause a broken circuit. He has had the device patented in Canada and the United States.

MONTREAL has entered an action for $1,544.25 against the Royal Electric Company, a claim for taxes alleged to be due on the poles and wires of the company, and made up as follows: On 3,177 poles, at twenty-five cents per pole, $794.25, and one per cent. on $75,000, value of the wires, $750.

THE Hamilton, Grimsby & Beamsville Railway directors have employed R. H. Fraser, of Toronto, to survey a private route from Grimsby to Grimsby Park, to avoid going along the road, owing to the high terms asked for the privilege by the Grimsby council. The right of way will be purchased.

THE project to span the Niagara River with a wonderful building, says the Hamilton *Herald*, is one of the biggest things we have come across in some time. And what strikes us as particularly remarkable about it is that it did not originate in the fertile brain of E. A. C. Pew.—*St. Catharines Journal.*

THE new board of directors of the Hamilton Radial Railway Company is as follows. Rev. Dr. Burns, president; A. McKay, M.P., vice-president, J. D. Andrews, secretary, W. G. Lumsden, treasurer, James Masson, M.P., Owen Sound, F. A. Carpenter, A. H. McKeown, E. P. Powell, London, Ont.; J. F. Smith, Thomas Ramsay, and R. McKay

THE H., G. & B. Electric Railway Company has an agreement with the H. & D. Railway Company by which it has permission to use the tracks of the latter on Main street until June 30. It has asked to have this permission extended, but the H. & D. Railway Company has refused the request, and the intervention of the Hamilton City Council is sought by the H., G. & B.

THE Ottawa *Journal* says: "The Ottawa and Aylmer Railway and Bridge Company, Limited, composed of the leading shareholders of the Ottawa Electric Street Railway Co., will begin the building of an electric railway to Britannia by the tenth of April, and anticipate having the line completed six weeks later. The line will run along the south side of the Richmond road, at a distance of twenty feet from the roadway.

THE promoters of the Canadian Electric Railway and Power Company, which proposes to build an electric line from Windsor to Montreal, are Castle Smith, London, Eng.; J. K. Osborne, T. M. Jones, C. W. Beardmore, W. H. Cawtura and Edmond Bristol, of Toronto, and E. F. Fauquier, of Ottawa. The application was opposed by the Grand Trunk and C.P.R. authorities before the Railway Committee, and will receive further consideration.

AT the annual meeting of the Citizens' Light and Power Co., Ltd., Montreal, the following officers were elected directors:—R Wilson Smith, president; ex-Ald. Lyall, W. McLea Walbank, vice-presidents; J. H. Burland, M. P. Davis (Ottawa), J. H. Heneault, mayor of St. Cunegonde. F. Dagenais, of St. Henri. This company is acting in concert with the Lachine Power and Light Co. It has also bought out the Standard Light and Power Co., whose rights extend all over the Province of Quebec. The company propose to put their wires underground at an early date.

THE Hull Electric Company has obtained water-power for the operation of their electric railway and lighting plant. It is at Deschene mills, between the island and Conroy Bros.' mill. The estimated cost, aside from that of placing dynamos and other electrical machinery, is $25,000. The plant will be operated by five 60-inch special new American turbine water-wheels. At a meeting of the shareholders the following were elected directors:—W. J. Conroy, President; R. H. Conroy, Chas. Magee, vice-presidents; F. A. Magee, James Gibson, J. M. McDougall, Q.C., E. Seybold, managing director, and Theophile Viau.

THE Bell Telephone statement shows that the past year has been very satisfactory. The gross revenue for the year amounted to $1,087,124.28, and the expenses $787,249.36, making the net revenue $299,874 92. Approximately the earnings amounted to 9½ per cent, against about 9 per cent. a year ago. The number of new subscribers added during the year was 1,028, making the total number of sets of instruments now earning rental, 28,809. Over 500 miles of poles and 1,760 miles of wire have been added to the long distance system in 1895. The long distance lines now owned and operated by the company comprise 14,851 miles of wire on 5,884 miles of poles, which include a copper circuit from Montreal to Toronto constructed during the past year. The annual meeting authorized the issue of bonds amounting to $600,000 to meet expense of new buildings and to carry on the pending underground work in Montreal. The following directors were elected: C. F. Sise, Robert McKay, W. H. Forbes, John E. Hudson, R. Archer, Wm. R. Driver, Hugh Paton and Charles Cassils.

Mining Matters.

PICTOU, N.S., coal mines are being worked full time.

SHAFT No. 3 of the Lethbridge, Alberta, coal mines, has shut down.

THE New Vancouver Coal Co., B.C. exported 15,000 tons of coal in January.

THE New Vancouver Coal Co. is going extensively into the stone quarrying.

THE C.P.R. will use Galt, Alberta, coal on the Winnipeg division of the road.

THE Iron Mask Gold Mining Company, of Spokane, U.S.A., is registered to mine in British Columbia.

THE French Creek Mining Company, of Milwaukee, U.S.A., is registered to mine in British Columbia.

THE strike at the Joggins mine is over. The men concluded that half a loaf was better than no bread.

ANOTHER extensive deposit of hematite iron has been discovered on the west coast of Newfoundland.

THE Mines Contract Co., of London, England, a Transvaal mining company, is said to be looking for investments in Ontario.

THE British Columbia Syndicate, Limited, of Rossland, B.C., capital $100,000, is a general mining company recently incorporated.

D. JORDAN, West Wellington Coal Mining Company, has made a satisfactory arrangement with his creditors, and the mine will resume.

G. F. MONCTON, M.E., has bought the assay plant formerly the property of the Vancouver Smelter Co., for the Vancouver Mining School.

THE iron ore bearing ledge at Port Kells, B.C., has been traced for three-quarters of a mile, and is said to assay 72 per cent. of iron.

THE Main Quesnelle Gold Dredging and Mining Company, of Tacoma, U.S.A., has been registered to do business in British Columbia.

THE *New Glasgow Chronicle* notes activity in Goldenville. A pumping plant has been set up at the Coburg mine and the shaft will be kept dry.

THE report of the Geological Survey on the iron deposits along the line of the Kingston and Pembroke Railway is expected to be published shortly.

THE matter of building a smelter at Rossland, B.C., for the War Eagle Mine, is to be left over till the routes of the various railway schemes are decided.

THE General Mining Association of Quebec is asking the Provincial Government for a grant of $2,500 to aid in establishing a mining bureau in Montreal.

DR. DE BERTRAM and other New Yorkers are inspecting the coal deposits along the line of the Central Railway in Nova Scotia, with a view to development.

THE Halifax Chrome Co is applying for incorporation with a Nova Scotian charter, capital $60,000, C. E Willis, of Halifax, and others, provisional directors

NEW BRUNSWICK granite will look for a market in England this season. B H Appleby, of the Spoon Island quarries, on the St. John River, will ship by the Beaver line

WESTERN papers speak of the discovery of some supposed diamonds in the Rocky Mountains. It may be so, but seeing is believing, where diamonds are concerned.

THE P. P. Moncton Co., which is trying to establish a smelter in Vancouver, B C, has selected a site, and the Vancouver city council has the matter under consideration.

THE Ingersoll Sergeant Drill Department has presented the School of Mines, Kingston, Ont., with a steam rock drill valued at $300. The gift is appreciated by the school.

ED. FEARON, M.L.A, of Maple Creek, Assa., is trying to interest eastern capital in the development of the manganese deposits in the Cypress Hills, says the *Regina Standard*.

E C WALKER is president and Dr S King managing director of the reorganized Ontario Natural Gas Company, of Walkerville, Ont. Operations will be at once resumed.

W LOVERIDGE, manager of the Duke of York mine, Alberni, is putting in an hydraulic plant, and is setting up a saw mill to cut the necessary lumber for a mile and a quarter flume

THERE is a prospect of the opening of mail routes to Lesser Slave Lake and Chipewyan by way of Athabasca Landing This would be of great advantage to prospectors and others

THE tramway recently built for the Nelson, B C., smelter, has turned out a failure, and the smelter people have 75 teams hauling the ore The tramway is 4½ miles long, and cost $60,000.

THE New Glasgow Mining Co. are putting in a ten-stamp mill by Fraser Bros., New Glasgow, at their Country Harbor mine Matheson & Co., of the same town, are supplying the boilers.

A. B. HENDRYX, manager of the Kootenay Mining and Smelting Company, Pilot Bay, B.C., says that the smelting plant is to be enlarged at once The company has expended $650,000 to date.

MINING in Nova Scotia during the past year has not been so prosperous as formerly. Gypsum shows an increase of 27,000 tons, and gold 3,000 ozs., but coal sales have fallen off 188,000 tons

THE capital stock of the Acadian Coal and Coke Co., Ltd., has been reduced from $1,250,000 to $100,000 by the issue of supplementary letters of patent. The preferred stock of $300,000 is extinguished.

THE O K mine will put in a 10-stamp mill in the spring. After many vicissitudes the main tunnel is now in seven feet of ore, which gives every indication of being a true contact vein.—*Rossland Miner*

THE Credit Forks Mining and Manufacturing Company have been incorporated under the Ontario Statute, capital $200,000. Building stone will be quarried, and lime, cement, and pressed brick manufactured.

THE stamp mill at the School of Practical Science, Toronto, has been placed in position and the initial tests have proved it satisfactory The gold crushed in the trial test was from the Belmont Mine, Peterboro' Co., Ont.

THE United Alberni Gold Mining Company and the Mineral Creek Gold Mining Company, of British Columbia, have settled their differences and joined forces for work James Dunsmuir is president of the new corporation

PROF. W. T. SUTTON, recently appointed to a chair in the Michigan School of Mines, says that the coal deposits of Vancouver Island are the only strictly first-class coal as yet discovered on the Pacific coast The Alberni Canal is a harbor that extends twenty miles into the interior, deep enough to float the largest ships, and having enormous deposits of coal and gold along its banks

THE Dominion Dredging Company have been refused their license to dredge the Fraser River at Lillooet on the ground that the ground is already occupied by claims. As these claims are unimproved, however, the D D. Co. hope to obtain them ultimately.

JOHN MCFEE, manager for the Chandos Mining Company, has sent a car-load of copper ore from their mine in Chandos, Peterboro' county, Ont., to a reduction works at Waverly, New Jersey, for quantitative assay on a large scale. The ore is copper sulphonets, apparently of great richness.

AT the annual meeting of the Consolidated Coal Company, Ltd., Amherst, N S, the following directors were elected. J. T. Smith, president and manager, T J. Copp, vice-president, C. R. Smith, C W Hewson, and Charles Smith, of Port Greville, and Rupert F. Bent, secretary and treasurer. Operations at the Maccan mines are being actively pushed.

DURING the year 1895, the Alamo Mine, New Denver, B.C., shipped 95 car loads of concentrates. The returns from 84 of these amount to $175,322. The cost of the mine with flumes, concentrator, tramway, etc., amounted to $125,000. A dividend of $35,000 was declared last fall, and another of which the amount is not yet fixed will be declared soon.

THE Le Roi Mining and Smelting Company has declared a dividend of $50,000, payable on February 1. This is 10 cents a share on the capital stock of the company, which is 500,000 shares of the par value of $5 each. With this payment $75,000 has been paid within the past few months, and the probabilities are that monthly dividends will be declared from this on.—*Midway Advance.*

SOME facts on the capitalization of B.C. mines may be gleaned from the *Colonist* of recent date: The statement in yesterday's *Colonist* that the Nest Egg Company was capitalized for $800,000 was the result of a typographical error. The amount is $500,000 nominal, the figure at which nearly all Trail Creek mining companies are incorporated. Shares are $1 each, and a number of fully paid up shares will be placed on the market at 10 cents per share. War Eagle shares sold originally in Spokane at 5 and 6 cents per share, and are now valued at $2.50 per share.

AT the third annual meeting of the Ontario Mining Institute, held in Toronto on the 4th March, the following officers were elected President, J J Kingsmill, Q C, vice-presidents, W. G Motley, C E. Rat Portage, James McArthur, Sudbury, Hon. E. H Bronson, Ottawa, and J. B. Smith, Rat Portage; secretary, B. T A Bell (re-elected); treasurer, Wm. Gibson (re-elected); council, A Blue; John F. Caldwell, of the Sultana mine, Rat Portage; A. C. Hammond; J. M. Clark, Kingston; Hamilton Merritt, E. R. Mickle, W. Coleman, and W. Van Somers. J. Latimer was appointed auditor. It was decided that the next annual meeting should be held at Rat Portage. J. Conmee, M.L.A., was in the chair. The Institute will invite the Iron and Steel Association and the Institution of Civil Engineers, of Great Britain, to meet in Toronto at the same time as the British Association for the Advancement of Science. During the meeting, Prof. Coleman, School of Practical Science, Toronto, read a valuable paper on "Ontario as a Mining Country."