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# The Canadian Engineer

ESTABLISHED 1893.

WITH WHICH IS INCORPORATED

THE CANADIAN MACHINE SHOP.

VOL. XIV.—No. 4. TORONTO, APRIL 5th, 1907. PRICE 15 CENTS / $1.00 PER YEAR.

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THE CANADIAN MACHINE SHOP

ISSUED WEEKLY IN THE INTERESTS OF THE CIVIL, MECHANICAL, STRUCTURAL, ELECTRICAL, LOCOMOTIVE, STATIONARY, MARINE, MINING, METALLURGICAL AND SANITARY ENGINEER, THE SURVEYOR, THE MANUFACTURER, THE CONTRACTOR AND THE MERCHANT IN THE METAL TRADES

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### SPECIAL NOTICE.

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## HANDS ACROSS THE SEA.

II.

### Possibilities of an Iron and Steel Clasp Between Britain and Canada.

The number of manufacturing establishments, the value of their machinery, motive power, tools and implements, in 1901, is an interesting index to the state of the market for machinery. Again it is impossible to give later statistics than for the year 1901. In order to facilitate reference, the figures for each province are given in detail.

| Province. | Establishments. | Machinery and motive power. | Tools and implements. | Total capital. |
|---|---|---|---|---|
| British Columbia. | 392 | 3,538,399 | 1,817,565 | 22,901,892 |
| Manitoba ...... | 324 | 1,619,006 | 255,225 | 7,539,691 |
| New Brunswick . | 919 | 5,202,803 | 1,047,945 | 20,741,170 |
| Nova Scotia .... | 1,188 | 10,607,179 | 3,555,180 | 34,586,416 |
| Ontario ....... | 6,543 | 40,989,517 | 9,674,045 | 214,972,275 |
| P. E. Island .... | 334 | 217,000 | 313,018 | 2,081,766 |
| Quebec ........ | 4,845 | 28,273,590 | 5,148,487 | 142,403,407 |
| Territories ..... | 105 | 382,407 | 92,445 | 1,689,870 |
| Total ......... | 14,650 | 90,829,901 | 21,903,910 | 446,916,487 |

The power employed in manufacturers establishment in 1901 was as follows:—

| Province. | Steam engines. No. | Steam engines. H.P. | Gas and gasoline engines. No. | Gas and gasoline engines. H.P. | Water wheels. No. | Water wheels. H.P. |
|---|---|---|---|---|---|---|
| British Columbia.. | 415 | 22,048 | 13 | 102 | 20 | 618 |
| Manitoba ....... | 147 | 10,796 | 10 | 75 | 4 | 140 |
| New Brunswick .. | 483 | 33,743 | 6 | 43 | 175 | 9,483 |
| Nova Scotia .... | 498 | 38,068 | 14 | 115 | 269 | 17,301 |
| Ontario ........ | 3,319 | 181,652 | 156 | 1,455 | 1,172 | 77,313 |
| P. E. Island ..... | 49 | 1,522 | 3 | 10 | 11 | 242 |
| Quebec ......... | 1,580 | 89,455 | 37 | 238 | 1,031 | 116,455 |
| The Territories .. | 67 | 2,956 | 5 | 40 | 1 | 90 |
| Total .......... | 6,558 | 380,240 | 244 | 2,078 | 2,683 | 221,642 |

| Province. | Electric motors. No. | Electric motors. H.P. | Other motors. No. | Other motors. H.P. | Supplied to other establishments. H.P. | Supplied by other establishments. H.P. |
|---|---|---|---|---|---|---|
| British Columbia.. | 49 | 878 | .. | .. | 280 | 321 |
| Manitoba ........ | 61 | 455 | 1 | 150 | .. | 361 |
| New Brunswick .. | 41 | 459 | 2 | 14 | 400 | 431 |
| Nova Scotia .... | 53 | 1,135 | 6 | 72 | 158 | 152 |
| Ontario ........ | 1,426 | 21,767 | 67 | 1,988 | 9,397 | 12,327 |
| P. E. Island ..... | 1 | 4 | .. | .. | .. | .. |
| Quebec ........ | 572 | 21,678 | 3 | 8 | 15,604 | 14,766 |
| The Territories .. | 3 | 85 | .. | .. | .. | .. |
| Total .......... | 2,206 | 46,461 | 79 | 2,232 | 25,839 | 28,358 |

While the problem of securing the elevated tracks for the steam railroads within the city of Toronto is being solved, it is worth while bearing in mind what has been accomplished in Chicago. Within that city there were sixteen hundred miles of tracks on the level, which produced annually about five hundred accidents to persons crossing them. Half of the trackage has been elevated and the other half is in process of being lifted up. The total cost of the change will be $100,000,000, all of which will be paid by the railroads. Under a law which has been upheld by the courts, the city can compel the removal of any public nuisance at the expense of the individuals or corporations creating it. Such a ruling cannot be hoped for by any Canadian hater of corporations. The Toronto improvement will necessarily involve some such arrangement as that under which railroad tracks in Philadelphia were raised. The city gave $900,000 in bonds, besides vacating a whole street for the improvement of the Pennsylvania line. The level crossing in populous places is becoming a barbarous anomaly; which is bad. It is almost as ridiculous as an investment. Which is worse.

### Horse-Power Utilized in Canada.

The aggregates and averages of horse-power utilized in the Dominion during the same year in 6,620 manufacturers' establishments was 652,653 horse-power, an average of 98.6 per cent. per establishment. The following are the details for each province.

| Province. | Establishments. No. | Aggregate horse-power. No. | Average h.p. per establishment. %. |
|---|---|---|---|
| British Columbia | 237 | 23,646 | 99.8 |
| Manitoba | 152 | 11,616 | 76.4 |
| New Brunswick | 473 | 43,742 | 92.5 |
| Nova Scotia | 493 | 56,691 | 115.0 |
| Ontario | 3,468 | 284,175 | 81.9 |
| Prince Edward Island | 52 | 1,778 | 34.2 |
| Quebec | 1,691 | 227,834 | 134.7 |
| The Territories | 54 | 3,171 | 59.0 |
| Total | 6,620 | 652,653 | 98.6 |

The various classes of power may be thus divided:

| Class of power. | Engines, motors, etc. No. | Horse-power. No. | Rate of power. %. |
|---|---|---|---|
| Steam engines | 6,558 | 380,240 | 58.26 |
| Gas engines | 244 | 2,078 | 0.32 |
| Water wheels | 2,683 | 221,642 | 33.96 |
| Electric motors | 2,206 | 46,461 | 7.12 |
| Other powers | 79 | 2,232 | 0.34 |
| Total | 11,770 | 652,653 | 100.00 |

In considering the foregoing tables, it must be remembered that five years have elapsed since they were compiled. Much has happened in Canada in the past five years. Its industries, its agricultural and commercial fame were, five years ago, beginning to become recognized. The world knows now that in the Dominion exist numerous unexploited markets. The demand for iron and steel and machinery of all kinds was large five years ago; to-day it is far greater. In another five years it will be greater still. Then again the recent development of the Canadian West has been one of the most remarkable features of Canadian expansion.

### Must Have Canadian Agents.

The names of English engineering firms are almost household words the world over. There are big engineering centres in almost every part of Britain, Yorkshire, Lancashire, Scotland, Gloucestershire, and half a dozen other centres.

One error in the campaign work of British firms to which the Canadian Engineer would draw attention, is that too frequently have they imagined that their New York agent can deal with Canada. The sooner the up-to-date firms recognize that Canada is, and must be reckoned as a separate country, the better for all interested. The general rule has been in the past, to say: "Oh, let the Canadian business be done through our New York or Boston agency." It is seen now what opportunities have been lost in the past. British firms are establishing agencies in the great Canadian cities, which is far from being unwise, foolish, or shortsighted.

There are numerous firms in Lancashire who do no business with Canada, simply because they have no recognized up-to-date Canadian agency. Messrs. Crossley Brothers, whose gas and oil engines, find their way into all corners of the globe, is one of the firms which is not overlooking Canada. They are shipping four to five hundred horse-power gas engines, and two 250 horse-power engines, in addition to the producer plant for driving the same, to Winnipeg for use at the pumping station.

Within three miles of the Manchester Royal Exchange, stand the engineering works of Sir W. G. Armstrong, Whitworth & Co. Their premises cover almost fifty acres. This is another firm which recognizes the possibilities of the Canadian market and the demand from this country for their steel, is rapidly increasing.

### Natural Conditions Overcome.

The natural conditions of the Dominion make it rather a difficult matter to use to any great extent, heavy motor wagons. But nature has never been allowed to stand in the way of Canadian commercial progress. If the British firms could build the right kind of heavy propelled wagon, there will be no difficulty in finding a market on this side of the Atlantic for that vehicle.

The Coulthard Motor Wagon Co., of Pereston, Lancashire, have already introduced their motor wagon into this country and are making such mechanical alterations and improvements as are necessary for the conditions existing here.

In Yorkshire there are many reputable engineering firms. That English county has already a big clientelle in South America, but as yet its Canadian business is comparatively small. Hunslet, where the smoke of shafts tells a tale of industrial enterprise. agricultural engineering and locomotive building are paramount. Other districts are manufacturing traction engines, steam ploughs, road rollers, horticultural, and agricultural machines, textile machinery, hydraulic and electric cranes, machinery tools, and a hundred other things.

### Time and Money not Wasted.

From Yorkshire is exported main line engines for Indian and British railways from Messrs. Manning & Wardle. Light locomotives, transport trains, with agricultural machinery, leave the works of Messrs. John Fowler & Company. To every quarter of the globe, is exported the industrial machinery of Messrs. Greenwood & Batley. The Yorkshire firm who make hydraulic machinery their specialty is Messrs. Henry Berry & Co. Hydraulic and electric cranes are turned out by Messrs. J. Booth and Bros., Limited, of Rodley, Leeds, and Messrs. Whittaker Bros., of Horsforth. This latter firm manufactures a patent steam crane navvie which will excavate daily some 500 to 1,600 cubic yards.

There are many manufacturers of war materials. But Canada happily, big and rich as the country is, has no interest in operations which destroy commercial peace and prosperity.

Dotted all over the British Isles are iron and steel manufacturing firms, expansion in whose business would be but a natural outcome of a study of the Canadian market. A personal investigation of these trade opportunities will be neither a waste of time nor money.

## TO LESSEN RAILWAY ACCIDENTS.

It is a matter of the greatest possible public interest that accidents on railways should be reduced to a minimum. The railways of Canada are undoubtedly doing their utmost towards this end, notwithstanding what people may from time to time declare to the contrary. The management of these great systems would never have made such a success of their roads had they not adopted a variety of precautions for the safety of the public. No one knows better than they that an accident means not only the destruction of thousands of dollars' worth of rolling stock and delay to traffic, but also danger of prosecution, besides the gaining of an unenviable record with the travelling public. It stands to reason that great care will be taken by the railways to prevent accident.

That the manufacturers of the equipment in use by the railways will also exercise great care in its production is almost equally apparent, as the railways, in justice to themselves, would have to refuse to purchase supplies from works which turned out cars or rails which became responsible for accidents. In fact, at the recent annual dinner of the Canadian Society of Civil Engineers, Mr. King, of the Canada Car Works, spoke of the awful loss of life in America through accidents, and said that employers should do their utmost to ameliorate conditions so that the people might live out their days in reasonable safety.

Yet a cruel loss of life, through the instrumentality of railways, still continues. For the fiscal year ending June 30, 1906, some 361 fatal accidents occurred to passengers, employees and others on Canadian railways. It is encouraging to note that this is below the figures of the previous three years; still, it is nearly one death per day. The thought naturally arises, What can be done to lessen danger through railways?

In this connection a most interesting discussion arose out of a paper contributed by Mr. H. K. Dutcher, of the Canadian Society of Civil Engineers, at the last monthly meeting of that body in Montreal. The paper had reference to the value of the indentation test for steel rails. The discussion of the paper brought out the statement by several of those present, who had taken a special interest in steel rails, that the quality of these had deteriorated greatly during the past few years. Even the experts showed considerable diversity of opinion as to why this should be, but the concensus of opinion was that the present day rush was in no small degree responsible. Speaker after speaker commented upon some defect of the large rails now being turned out, and compared their quality unfavorably with the splendid, old, small rail. Eventually the chairman was requested to bring in a report at the next meeting with a view to appointing a committee of engineers, manufacturers and Government officials to see what could be done to improve matters.

The appointment, by the Government, of Mr. James Ogilvie as inspector of rolling stock and general equipment of Canadian railways, and the intimation that the position of inspector of railway accidents will shortly be filled, opens the way to a very thorough examination of the whole subject. Mr. Ogilvie is a civil engineer with experience in railway matters, having recently held the position of superintendent of motive power on the Ottawa division of the Grand Trunk; and no doubt a fit man will be appointed to the inspectorship of railway accidents.

Probably these officials will be invested with authority to carry their investigations to the point aimed at by the Society of Civil Engineers. If not, now is the time for the Society to act. The subject is most important, and none but those of both technical and practical knowledge may hope to grapple successfully with it. It is probably true that only a very small percentage of rails is unreliable. This, however, is a case of the chain being no stronger than its weakest link, and it only requires but one weak rail to occasion an appalling disaster. One thing which must touch us all keenly is that no one knows but that he may be the sufferer.

The Society will be doing the public a very great service in taking further active interest in the knotty problem they have been discussing, and which is of such great importance to the entire country.

## MINERAL WEALTH OF ONTARIO.

The mineral production of Ontario for the year 1906, according to the report prepared by the Bureau of Mines, shows an increase of more than four million dollars over 1905, the total output being valued at $22,221,808, as against $17,809,226 in 1905. These figures are based on the value of the minerals while in the form in which they are exported. The net value of the metallic output amounted to $13,179,162; the non-metallic, $9,042,646.

Noteworthy gains during the year were: silver, with an excess value of $2,170,212; nickel, $481,485; copper, $309,555; pig iron, $644,720. In the non-metallic group, Portland cement heads the list with an advance in production of $595,563, and the excess value of natural gas was $216,970. There was not as much crude petroleum produced as in 1905, the value falling off $126,999.

There was a considerable increase in the output of the various products from the Cobalt mines over 1905. The total output of silver amounted to $5,357,830 ounces, valued at $3,543,089, the 1905 output being valued at $1,360,503; Cobalt, 312 tons, valued at $300,819, as against 118 tons, valued at $100,000, in 1905. There was an excess in the output of nickel of 81 tons, the output in 1905 being only 75 tons, valued at $10,000. The output of arsenic was somewhat less, being valued at $1,558, as against $2,693 in 1905.

Up to the close of 1906 the Cobalt camp has produced 8,016,061 ounces of silver at a total value of $5,015,475; 446 tons of cobalt, 245 tons of nickel, 1,919 tons of arsenic. These three last-named minerals have brought little or no return to the mine owner. They are, however, estimated to be worth $150,779, $13,467, $3,596, respectively. However, the production in 1906 was very much greater than in 1905.

Taken as a whole, it may be said that last year was an exceptionally successful one, and if present indications of operations in the various mining camps are to be taken as a criterion, this year's output should surpass to an extent which it is almost impossible to predict that of any previous year in the mining history of the Province.

## PIG IRON.

The pig iron production of the Dominion is keeping pace with the growth of other industries. In thirteen years the increase has been about 1,200 per cent., an average of nearly 100 per cent. per year. In 1894 the output was 44,791 tons, and in 1906, 541,957 tons. The production of last year was double that of 1904, when the output was only 270,942 tons. The output per year since 1894 up to last year is given in the following table:—

| | | | |
|---|---|---|---|
| 1894............. | 44,791 | 1901............. | 244,976 |
| 1895............. | 37,829 | 1902............. | 319,557 |
| 1896............. | 60,030 | 1903............. | 265,418 |
| 1897............. | 53,796 | 1904............. | 270,942 |
| 1898............. | 68,755 | 1905............. | 468,003 |
| 1899............. | 94,077 | 1906............. | 541,957 |
| 1900............. | 86,090 | | |

Last year there were thirteen blast furnaces in operation, and in 1905 there were thirteen during the first half of the year and twelve during the latter half. The outlook this year is exceptionally bright, and when the immense iron ore discoveries around Port Arthur are developed an output of at least half as much again as that of 1906 may be looked forward to.

It will be many a year before the products of Canadian foundries will approach in quantity and range those of the United Kingdom. But by way of encouragement along the road of expansion it is useful to notice what is being done across the Atlantic, not so much in the methods of output as in attested annual statements of profits and dividends. The latest mail brings details of nine leading companies whose products range from the armor plates, guns and ships turned out from steel of their own manufacture by Vickers, Sons & Maxim, to the gas engines constructed by the famous Manchester firm of Crossley Bros, the kitchen ranges of John Wright & Company, and crude steel by the Barrow Hæmatite Company. En passant, it is interesting to note that the Vickers, Sons & Maxim shipyard at Barrow, on the Lancashire coast, is probably the best-equipped shipyard in Britain, and that the town, where it, as well as the Barrow Hæmatite Company is located, was less than a generation ago afflicted with grass-grown streets in proof of the destruction of its early hope that it would become a great centre of iron and steel manufactures.

Of nine companies, seven reported considerably increased profits and four paid larger dividends. There were two reductions in earnings, but no case of a reduced dividend. In the aggregate, the nine companies earned during 1906 a net profit of £1,407,388, which, compared with a total of £1,218,956 in 1905, is an increase of 15.4 per cent. The year 1905 was itself better than its predecessor, but, though the results for 1906 are as regards profits alone very good, they do not indicate that there was anything in the nature of a "boom" in the engineering trades. The following is a statement of net profits and dividends in 1906 as compared with 1905:—

**I.—Net Profits and Dividends.**

| Company. | Net Profit. £ | Dividend. % | Net Profit. £ | Dividend. % |
|---|---|---|---|---|
| Barrow Hæmatite Steel | 49,182 | 2½ | 35,002 | 1 |
| Beyer, Peacock and Co. | 56,863 | 10 | 20,944 | † |
| Crossley Brothers | 92,990 | 11 | 85,620 | 11 |
| Harvey United Steel | 100,906 | 15 | 118,712 | 15 |
| John Wright and Eagle Range | 54,113 | 20 | 54,785 | 20 |
| Measures Brothers | 15,527 | 5 | 9,040 | † |
| Swan, Hunter, and Wigham-Richardson | 107,226 | 6¼ | 67,710 | 5 |
| Vickers, Sons & Maxim | 879,905 | 15 | 787,778 | 15 |
| William Jessop & Sons | 50,676 | 8¾ | 39,365 | 8¾ |
| | 1,407,388 | .... | 1,218,956 | .... |

Here is a statement of profits used otherwise than for dividends:—

| Company. | Applied to extensions, reserves and depreciation. 1906. £ | 1905. £ | Total Reserves. £ |
|---|---|---|---|
| Barrow Hæmatite Steel | 39,735 | 17,214 | 50,000 |
| Beyer, Peacock, and Co. | 26,607 | 1,779 | 35,446 |
| Crossley Brothers | nil | nil | 100,000 |
| Harvey United Steel | 70,000 | 70,000 | 180,000 |
| John Wright and Eagle Range | 8,000 | 10,000 | 33,000 |
| Measures Brothers | 2,105 | 2,252 | 21,055 |
| Swan, Hunter, & Wigham-Richardson | 64,376 | 50,634 | 40,310 |
| Vickers, Sons, and Maxim | 250,000 | 137,457 | nil |
| William Jessop and Sons | 23,500 | 10,000 | 42,500 |
| | 484,323 | 299,336 | 502,311 |

† On Preference shares only.

There is considerable difference in methods of allowing for depreciation. Some companies deduct depreciation before arriving at their net profits, and others deal with it in the distribution of their earnings. But the general practice is to make large allowances for depreciation, which explains the apparent smallness of some reserve funds. Vickers, Sons & Maxim, for instance, have no reserve fund at all, but an amount of £765,311, formerly accumulated, was devoted to writing down the item of good-will and patent rights. The good-will of a business earning £880,000 per annum is equivalent to a reserve fund of large amount. The Harvey United Steel Company also devotes very heavy sums to other purposes than dividends. Last year it returned half its capital to the shareholders, wrote down unexpired patents £150,000, and its holding in a French company by £50,000.

These figures have several aspects of novelty for Canadian readers, and indicate what an extraordinary difference there is between the conditions of mature and infant industries. We are in the bonus stage, but our turn for large dividend returns will surely come.

## EDITORIAL NOTES.

According to a pamphlet by G. K. Gilbert, of the United States Geological Survey, the recession of the cataract at Niagara Falls is exceptionally rapid. He says this depends primarily on the great power of the falling water, but that it is partly due to the character of the local geological structure. The recession of the American Falls is much slower than that of the Horseshoe Fall. The depth of water at the American Fall is comparatively shallow, and the force it acquires in falling is not sufficient to move the larger of the limestone rocks, which are broken from the ledge above. On this account these large blocks are heaped at the base of the cliff, forming a natural riprap to protect the shale against wear. The data upon which the rate of recession is computed include surveys of the crest line made in 1842, 1875, 1886, 1890 and 1895, and camera lucida sketches made in 1827. During this period the rate of recession has not differed to an important extent from the natural conditions, and the present use of the water for power purposes, which interferes with the course of nature, may be expected to modify the rate of recession. The Horseshoe Fall has been found to be receding during the period from 1842 to 1905 at the rate of five feet per annum, one foot of this distance being questionable. The rate for the first thirty-three years of this period was somewhat slower than for the latter part of the time. During the period from 1827 to 1905 the American Fall has receded at a rate of less than three inches per annum.

* * * *

"If the Canadian people would only make their pig iron more uniform so as to approach the Swedish standard." This is the opening line of the report of the Leeds and Hull Commercial Agent for the week of March 11th. He says that if Canadian pig iron was brought to the standard of the Swedish product 50 per cent. more would be paid for it by British buyers than what they are now paying. At the present time Canadian pig iron being shipped to Liverpool is of an exceptionally good grade, and, according to the Commercial Agent, English manufacturers always give pig iron shipped from this country preference over the iron produced at Middlesborough. Although it is not practical for exporters to transact their business with Old Country buyers direct, there must certainly be numerous opportunities through which the trade with Britain could be increased. One of the reasons that makes it impossible for exporters to do business direct with British buyers is the fact that they desire to sample the metal before purchasing, and then analyze it in their own laboratories. It is high time that manufacturers of pig iron in this country made a closer study of the requirements of the British market, especially in view of the fact that buyers in the Old Country are always ready to give preference to the imported product. As the trade report states, the call for pig iron shipped from Canada would make the effort on the part of the manufacturers worth while, and prices would soon be on a par with those paid for the Swedish product. This suggests the opportunity there is for the Canadian manufacturer to make use of the electric smelting process by which the large deposits of refractory ores that are located in various parts of the Dominion can be turned into the very finest grade of pig iron. Prices being paid for the different makes of pig iron in the Old Country at the present time are as follows: Middlesborough warrant, $12.96 to $14.40 per ton; Canadian, $26.40; Swedish, $31.20 to $48.

## MARKET CONDITIONS.

Montreal, April 3rd, 1907.

The changes in the iron and steel markets during the past week have not been many or violent. The car situation has not improved to the extent hoped for. Shippers are still experiencing much difficulty in getting a sufficient number of cars to ship material and the general idea seems to be that this difficulty will be experienced for some time to come. Meantime, the railways are so far behind with their work that any improvement which may be taking place is hardly noticeable. Applications for cars are liable to meet with no response whatever, or with only partial success at best. The opening of navigation will take place in about five weeks now, and the movement of freight will then be much more active. In any case the railways will have all the traffic they can attend to and at the same time get themselves into shape to look after the crop movement of next fall.

Latest cables report the English speculative market slightly easier, warrant iron being quoted at a fractional reduction in price. In the middle of March there were about 480,000 tons of warrant iron in Connel's stores as against 740,000 tons last year on the same date, so that the reduction in quantity is very considerable. Prices also were lower, being about 4s. less than they now are. It is thought that the recent easiness in the warrant market is due largely to tight money, and that the decline was in sympathy with the stock market. At any rate, makers of iron are certainly well sold up. Stocks are very light and there is a good market for everything that can be spared. The tone of the market, too, seems to be quite firm.

There is very little doing in the iron and steel markets of the United States. Business is of a semi-holiday character, being influenced to no small extent by the situation in England, where business houses were closed for Easter holidays of fully half a week.

**Iron.**—Prices and conditions hold unchanged. Londonderry iron is unobtainable for immediate shipment, while prices for second half are on a basis of about $23.50 to $24, f.o.b., Montreal. Toronto prices are about $1.25 more. Summerlee is practically the same as Londonderry, and is quoted $25.50 to $26 for immediate delivery. No. 1 Cleveland is quoted at $18.50 to $19 for delivery at Montreal, by water freights, while for immediate shipment it is $24.50.

**Structural Steel.**—At the present moment there appears to be a lull in the enquiry for structural steel shapes of all kinds. Dealers are in no way alarmed, however, as at any moment the demand may come on again. In fact, there is almost certain to be a considerable amount of activity during the coming summer, as an enormous amount of work requiring material of this nature is in sight. The market seems to be holding quite firm.

Heavy sections, weighing 35 pounds and upwards, per lineal yard, are quoted at 2¾c. per pound, light sections, under 35 pounds, being 3c.

**Steel Shafting.**—The demand for steel shafting continues much the same as for some time past, steadiness being one of the characteristics of this market. The volume of trade, however, is very satisfactory so far this spring, and it is expected that this will continue to be the case for some time to come. The discount to consumers is 30% off the list price.

**Steel Plates.**—Merchants report a slight falling off in the demand for steel plates of all kinds. During the past week, sales have been on the light side, but it is not thought that this state will be of long duration. Prices for 3-16 and ⅛ are $2.75, and for ¼ and thicker, $2.60 to $2.65.

**Machine Steel.**—Stocks of machine steel in Montreal are now very light indeed. Low stocks at this time of year are not unexpected, this being between seasons, but this year they are unusually low, which also was not unexpected. Merchants will not bring in any more stocks before the opening of navigation. As soon as there is open water, however, supplies will show a considerable increase. Round machine steel is quoted at $2.30, base, subject to the usual extras, reeled being $2.85.

**Boiler Tubes.**—There is a fair amount of activity, and it is likely that there will be a good turnover shortly. Prices for small lots are as follows: 2-inch, 8¾c. per foot; 2½-inch, 11c.; 3-inch, 2c.; 3½-inch, 16c.; 4-inch, 20c. In larger lots prices are ¼ to ½c. less than those quoted.

**Contractors' Machinery.**—Merchants report a good demand from all sections of the country. The market holds firm in tone and there is more difficulty, according to some reports, in getting supplies than in disposing of them.

**Machine Tools.**—The market is steady. Demand is not over active, but there is a fair trade passing at firm prices.

**Tool Steel.**—Canadian agents are still quoting former prices, notwithstanding the advance in the English and Continental markets. It is claimed that the local market will be advanced ½c. before long. Meantime, orders are being accepted at the old figures. The market is reported active. Base prices are as follows: Jessop's best unannealed, 14c. per pound, annealed being 15c., second grade 8c., and high speed, "Ark," 60c. These figures will be advanced 7½ to 10 per cent. after the end of this month, to conform with advances on the other side.

**Wire Rope.**—There is practically nothing new in the market. Demand is reported excellent. Prices are as follows: C.C.S., 6-19; ½-inch, 6c.; 9-16, 6½c.; ⅝-inch, 7c.; ¾-inch, 8c.; ⅞-inch, 10c.; 6-24 rope is about 1c. extra.

* * * *

Toronto, April 3rd.

Scarcity of iron and steel appears to be chronic; it is to be heard of everywhere, and manufacturers as well as dealers profess themselves unable to relieve the stringency. It is probable in structural steel that the scarcity is most felt, for in all parts of Canada buildings are projected and in a good proportion of them modern substantial construction is being adopted. Great are the complaints of delay for the reason that neither plates nor beams are to be had. And again, where some contractors have been able to get promise of frame-work material, delivery of it cannot be had because of the lack of railway cars which is another serious element in the situation.

Nor is the shortness of supply confined to steel and iron; there are complaints that the supply of wood is scanty. Dimension pine is hard to get; and we hear of a case where for two months a firm had a cargo of oak on order, and not getting delivery, cancelled, with the result that they are equally unable to get it elsewhere. Labor is scarce, too, both in building and other construction, for neither of laborers nor skilled mechanics can enough be found to satisfy the demand. "We could put a hundred additional skilled men to work this week," said Mr. Frank Polson to the "Canadian Engineer," "and I doubt if we can get ten." There is a chance that through the efforts of the railways and the Government agents a few weeks more will find English and Scotch mechanics and perhaps even laborers arriving in sufficient number to relieve the labor market.

An indication of the manner in which American producers of iron and steel are tied up is given in an occurrence of this week. A Toronto house having large dealings with the American Iron and Steel Co. ordered a small lot of special sized steel plate for a rush job, relying on long and friendly relations to get them some special consideration. After much writing and wiring the final reply came: the best that could be done was to deliver by 1st July. In this dilemma the Toronto house sent to England, and the best to be done there is shipment within three weeks.

In tools, machines, engines, and boilers there is continued activity of demand. All dealers in iron-working machinery report much the same condition. The intention of a Wisconsin firm of wood-working machines arranging to establish a branch in Hamilton testifies to the Canadian demand in this direction.

Quotations in metals are well maintained, but we are unable to report any material change. Opinions differ as to prices of iron and steel in the immediate future. While Old Country advices would lead one to look for an advance in English pig iron, if the present demand from over-sea countries keeps up, it is significant that the U. S. Steel Co. is willing to make a slight concession from present quotations for steel goods to be delivered in four to six months hence. This, however, is the only instance of the kind we hear of, and the exceptional activity in building in Canada portends any thing but lower prices here.

It must be remembered, of course, that the factor which dominates all others in constructive plans for the future is the continued tightness of money the world over. This and a possible poor harvest on this continent are elements whose shadow may have an effect in quelling the ardor of industrial extension now so rife.

Mail advices, 16th March, from Glasgow and London, say that pig iron warrants have fluctuated with a slightly downward tendency, but Cleveland makers are not following the warrant market and are firm.

Values of manufactured iron are well maintained in the United Kingdom.

In steel, there was more enquiry for export. Blooms and billets in good request both for home and export, some good enquiries being on Canadian account.

**Steel Boiler Plates.**—¼-in and heavier, $2.50.

**Boiler Heads.**—25c. per 100 lbs. advance on boiler plate.

**Tank Plate.**—3-16-in., $2.65.

**Sheet Steel.**—10 gauge, $2.80; 12 gauge, $2.70.

**American Bessemer Sheet Steel.**—14 gauge, $2.60; 17, 18 and 20 gauge, $2.80; 22 and 24 gauge, $2.90; 26 gauge, $3.00; 28 gauge, $3.25.

**Bar Iron.**—$2.30 from stock to the wholesale dealer.

**Tool Steel.**—Jowitt's special pink label, 10½c. per lb.

**Boiler Tubes.**—Lap-welded steel, 2-in., $9.10; 2¼-in., $10.85; 2½-in., $12.00; 3-in., $13.50; 3½-in. $16.70; 4-in., $21.00, per 100 ft.

**Wrought Steam and Water Pipe.**—Trade prices per 100 lbs. are: Black, ¼ and ⅜-in., $2.26; ½-in $2.72; ¾-in., $3.57; 1-in., $5.12; 1¼-in., $6.98; 1½-in., $8.37; 2-in., $11.16; 2½-in., $18.00; 3-in., $23.50. Galvanized, ¼ and ⅜-in., $3.08; ½-in., $3.57; ¾-in., $4.72; 1-in., $6.77; 1¼-in., $9.23; 1½-in., $11.07; 2-in, $14.96; 3½-in., blk, $30.00; 4-in., $34.00.

**Copper.**—The speculative market is oversold for standard metal, which is quoted to-day, £107, 5s. cash. Large enquiry for refined, and capacity of producers is overtaxed; market excited.

**Lead** firmer and market bare of supplies.

**Tin** quiet and featureless. To-day's prices in London, £190, 7s., 6d.

**Sheet Zinc** steady, no special demand.

## BOOK REVIEWS.

**The Cruise of the Neptune.**—Report on the Dominion Government Expedition to Hudson Bay and the Arctic Islands, 1903-1904. By A. P. Low, B.Sc., F.R.G.S., officer in charge. Government Printing Bureau, Ottawa, 1906.

To say that this is an interesting book is to do it far less than justice. It contains so much that is valuable and instructive as to commend it first to every business man who wishes to know more about a salt water sea with a coast line of 6,000 miles which washes the shore of Ontario equally with every lover of adventure and discovery who likes to read of risks run or wonders found.

The man who is now Director of the Geological Survey of Canada, A. P. Low, F.R.G.S., is the author of this volume, which describes an exploration of Hudson Bay, Hudson Straits, and northern estuaries of the American continent in 1903 and 1904, and gives the completest data yet to hand about those regions, so often nowadays upon people's tongues, but about which so little has hitherto been known. Hudson Bay is more familiar as a fur preserve for the company which bears its name than for anything else. It is now becoming known that the great inland sea is rich in edible fish and its shores rich in minerals. Extensive deposits of copper-bearing rocks, says Mr. Low, have been located between Chesterfield Inlet and Churchill, on the western shore, while iron ores have been found, first by Bell in 1877 and by Low in 1900, on the islands and shores of the eastern side, and on Ungava Bay. . . . A valuable mica mine is being worked at a profit on the north shore of Hudson Strait, and the forestry of the region through which rivers run into the Bay from the west and south promises rich results in pulp-wood and merchantable spruce. In James' Bay, brook trout and whitefish identical with the Lake Superior whitefish, are caught, weighing one to six pounds each, while on both shores of the strait, as well as on the east and north-west coasts of the Bay, the Arctic salmon, a fish described as superior to the fresh salmon of the Pacific, are plentiful. . . . Codfish in immense schools are found in Ungava Bay. According to Lieut. Gordon, there are "millions to the acre" of them; two of his crew filled a yawl boat with them in an hour. At Korak River, on the east coast of the Bay, "large schools of dark seals were seen," while "the presence of cod points to that of halibut in the deeper waters." In one river salmon have been taken weighing up to 14 pounds; and in another, of the Straits, boats have taken them by the thousand weighing 3 to 8 pounds. The porpoise, the walrus and the whale are also denizens of the Bay.

Such riches of the mineral kingdom and of the salt sea wave are enough to stimulate the enterprise of others than mere explorers. And there need be little wonder that Atlantic fishermen are, as we are assured, ready to transfer part of their fleet to Hudson Bay the moment that a means of transporting their catch 250 miles to Lake Superior will secure them a market in Michigan, Wisconsin and Illinois as well as in Ontario.

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**Concrete Factories.**—Compiled by Robert W. Lesley, New York: Bruce and Banning. pp. 152 $1.00

The newest contribution to cement literature, and one for which there has been a demand for a long time is "Concrete Factories," a series of papers descriptive of the uses of cement and concrete as applied to the construction of industrial plants.

The book offers in condensed form the most complete review of the principles underlying reinforced concrete construction that has yet been published and has the still further advantage of being understood by the layman as well as the engineer. It contains the report of the United States Advisory Board on Fuels and Structural Materials, the report of the Sub-Committee on Tests, the only translation of the French rules on reinforced concrete, which have just been issued by the Ministry of Public Works in France, and a number of profusely illustrated articles showing the methods of reinforced concrete construction including all well-known reinforcing systems.

"Reinforced Concrete Construction," a chapter by Walter Mueller, is perhaps the most concise description that has yet appeared on the many concrete reinforcing systems now on the market, and "Concrete in Factory Construction," by E. A. Trego, reviews the work that has been done with concrete in the construction of industrial plants during the past few years.

A chapter entitled "A Surface Finish for Concrete," by Henry H. Quimby, American Society of Civil Engineers, and a symposium of articles on the use of concrete in constructional work by Emile G. Perrot, C. A. P. Turner, E. P. Gooderich, J. R. Worcester, Dean & Main, Leonard C. Mason, E. S. Larned, Chester J. Hogue, J. G. Ellendt, A. E. Lindau, and other eminent authorities on concrete construction work are also included.

**The Principles and Practice of Coal Mining.**—By James Tonge, M.I.M.E., F.G.S. London: Macmillan & Co.; Canadian agents, the Macmillan Co., of Canada, Toronto. ($1.50 net.); pp. 363, 203 illustrations.

Although the coal mining industry of Canada has not yet been developed to as great an extent as in Great Britain and the United States, there is no doubt that the industry in this country is still in its infancy, and that the future has great possibilities in store.

With this end in view the mining engineer cannot afford to let this part of the profession go unnoticed. Mr. Tonge's book has been prepared to meet the demand of two classes; first, for the student who intends to adopt mining engineering as a profession; and secondly, for the practical miner, who is desirous of becoming a colliery manager or under-manager.

Mining consists largely in the practical application of geology, mechanics, physics, and chemistry, and, as it is difficult to know what to take for granted in a work of this kind, the author has made the book self-explanatory wherever possible. The subject is dealt with in a most exhaustive way, the first chapter dealing with geology in relation to coal mining, and the last one with accidents and diseases of miners, and legislation respecting mines, etc. Chapter III. is especially interesting, being a description of how coal is formed, and the illustrations which accompany it are very graphic. The remaining chapters, all of which are made very graphic by means of numerous illustrations, are as follows: Prospecting Coalfields, Boring, Sinking, Working, Modes of Working, Timbering, Haulage, Coal-cutting Machines, Winding, Mine Drainage, Principles of Ventilation, Production of Air Current, Mine Gases, Safety Lamps and Preparation of Coal for the Market.

The student in mining engineering, or the practical man at the mine who is desirous of advancing need not hesitate to purchase a copy of this excellent work upon such an important subject.

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**Reinforced Concrete.**

That the business man cannot properly do without his handbooks, his textbooks, his technical journal—the paper which is solely devoted to the interests of his trade or industry, whatever it may be—is a fact which is fast becoming recognized by the up-to-date captain of industry. One can always discover by a glance at their office bookshelf who are the nineteenth century men living in the twentieth century world. And the first book one would expect to find in the room of the man intelligently interested in the cement and concrete business would probably be "Reinforced Concrete," by Messrs. A. W. Buel, C.E., and Charles S. Hill. It is a reference volume which ably endeavours to treat of every phase of the industry, and one which admirably succeeds in its mission.

The drawback of so many technical reference volumes lies in the fact that they are nothing else but intricate technicalities and profound theories.

In preparing the present volume, the authors have had in mind a treatise for designing and constructing engineers following American practice and by the conditions which prevail in America, and they have omitted theoretical discussions, supplying in their place practical working formulas, examples of representative structures, and records of actual practice in the selection of materials and of methods of workmanship and construction.

The volume is not the result of the collaboration on the part of the authors, but is in reality, two books in one, Part I. dealing with the methods of calculation and the design of reinforced concrete, and Parts II. and III. treating with the details of, and methods employed in, constructing various classes of reinforced concrete structures.

In the first chapter, which touches upon the economic use and properties of reinforced concrete, the writer remarks that with the advent of modern concrete the facility with which reinforcing rods or bars of metal may be embedded anywhere in the mass of the masonry was soon seen and taken advantage of. The compressive resistance of concrete is about ten times its tensile resistances, while steel has about the same strength in tension as in compression. Volume for volume steel costs about fifty times as much as concrete. For the same section areas, steel will support in compression thirty times more load than concrete, and in tension three hundred times the load that concrete will carry. Therefore, continues, the writer, for duty under compression only, concrete will carry a given load at six-tenths of the cost required to support it with steel. On the other hand, to support a given load by concrete in tension would cost about six times as much as to support it with steel. These economic ratios are the raison d'etre of reinforced concrete.

Retaining-walls, dams, tanks, conduits and chimneys are exhaustively dealt with in chapter four. After giving much valuable data on these subjects, Mr. Buel says concerning dams, "reinforced concrete has been used to some extent for the construction of dams, for which purpose it is economical. It possesses the distinct advantage that the opening up of cracks can be guarded against by running the steel reinforcement in every direction desired." This advantage evidently appealed to those responsible for the construction of the 2,000 ft. concrete dam, which is a part of the Niagara power works recently completed.

A whole chapter is devoted to concrete foundation construction. The reinforced concrete is employed in three principal forms for foundation work—as spread foundations for walls and columns, as a capping for timber piles, and in the form of piles driven and capped like timber piles. "Its minor uses in such work are as a curbing or lining for foundation pits and as a sheathing or armoring for timber piles in teredo-infested waters." Building construction is dealt with in a very masterful article, which is illustrated with many interesting diagrams.

Perhaps reinforced concrete nowadays plays more part in bridge and culvert construction than in anything else. In Europe the concrete-steel girder bridge is much in evidence, but on this continent the most common form of the concrete steel bridge is the arch. "For longer spans than 50 feet," says the writer, in speaking of bridge and culvert construction, "arch construction is almost universally employed, and concrete arches of 165 feet span have been built and much longer spans of that material have been designed. The arch bridge of reinforced concrete occupies a position between the metal bridge and the cut stone arch; it possesses the quality of cheapness characteristic of the steel bridge, while having much of the beauty and durability of the masonry arch. When first introduced, the concrete steel arch bridge made its principal appeal to American engineers as a cheap substitute for the stone arch; its claims as a type of construction having an individuality and structural merit peculiar to itself were only gradually recognized."

Other subjects dealt with in this exceedingly comprehensive book are Examples of Reinforced Concrete Conduit Construction, Examples of Reinforced Tank and Reservoir Construction, Material Employed in the Fabrication of Reinforced Concrete Facing and Finishing Exposed Concrete Surfaces, etc. The volume has excellent indexes and is profusely illustrated with photographs, tables, and diagrams.

—The first battleship ever built in Japan was launched at Tokio, November 15, 1906. According to unofficial reports, the boat, the "Satsuma," is 482 ft. long, with an 83½ ft. beam, and has a displacement of 19,200 tons. Her armament will consist of 4.7 in. guns, while her speed will be 19 knots. She was built by Japanese labor exclusively, great secrecy being maintained regarding her design. It is interesting to compare the "Satsuma's" main dimensions with those of the new British battleship, the "Dreadnought," which are as follows: Length, 520 ft.; width, 82 ft.; displacement, 18,000 tons; speed, 21 knots, and main battery, ten 12-in. guns. From these dimensions it is seen that the "Satsuma" compares quite favorably with England's largest ship.

## GRAND TRUNK PACIFIC.

After three years of exhaustive explorations by a large staff of engineers for the most feasible and economical route through the Rocky Mountains, which comprised the Peace River Pass, the Pine River Pass, the Wapiti Pass, and a number of intermediate Passes, the company selected the Yellowhead Pass from Edmonton to Prince Rupert, B. C., which was approved by the Government in November, 1906. The great importance of the selection of the Yellowhead route can be estimated in considering the exceptionally low and favorable grades which have been obtained, the maximum gradient through the Mountains against eastbound traffic being as low as four-tenths of one per cent. or a total rise of twenty-one feet to the mile for the entire distance from Prince Rupert to Edmonton, which is no greater than the extremely low grades obtained on the prairie section of the line from Edmonton to Winnipeg. The maximum gradient against westbound traffic for the entire distance from Edmonton to Prince Rupert is almost equally favorable to that against eastbound traffic, being no greater than five-tenths of one per cent. or a total rise of twenty-six feet to the mile, and in crossing the mountains but one summit is encountered, the maximum altitude of which is only 3,712 feet. These remarkable conditions exist in this northerly locality on account of the fact that the ranges of mountains along the western portion of the American continent, which have their origin in Mexico, reach their maximum altitude in the region of the fortieth parallel of latitude, from which they gradually recede to the north. No better illustration of these physical conditions could perhaps be given than a comparison of the summits and gradients of the five existing American transcontinental railways with the Grand Trunk Pacific, which is shown below.

From this comparison it will be observed, as already stated, that in the case of the Grand Trunk Pacific but one summit is encountered having an altitude of 3,712 feet, with no greater grade in either direction than five-tenths of one per cent. or a rise of twenty-six feet to the mile, west of Winnipeg, which is increased to six-tenths of one per cent. east of Winnipeg, while in the case of the Canadian Pacific two summits are surmounted with a maximum altitude of 5,299 feet, and a maximum gradient of four and one-half per cent. or 237 feet to the mile; the Great Northern has three summits of a maximum altitude of 5,202 feet, and a maximum gradient of two and two-tenths per cent. or 116 feet to the mile; the Northern Pacific three summits having a maximum altitude of 5,569 feet, and a maximum gradient of two and two-tenths per cent. or 116 feet to the mile; the Union Pacific three summits having a maximum altitude of 8,247 feet and a maximum gradient of two and two-tenths per cent. in reaching San Francisco, and in reaching Portland, Oregon, five summits are encountered with a maximum altitude of 8,247 feet and a maximum gradient of two and two-tenths per cent.; the Atchison, Topeka and Santa Fe Railway six summits having a maximum altitude of 7,150 ft. and a maximum gradient of three and three-tenths per cent. or 185 ft. to the mile.

Where the Grand Trunk Pacific will reap the first benefit from these exceptional conditions will, of course, be in the great economy and low cost of operation which can be obtained from the very commencement, at a time when this item is of such vast importance in the case of a newly constructed railway, and when the traffic and the revenue therefrom must of necessity be light. From present indications, however, it would appear that the period of light traffic for this new transcontinental railway will be of comparatively short duration.

## COMPARISON OF SUMMIT ELEVATIONS, MAXIMUM GRADIENTS, AND TOTAL ELEVATION ASCENDED, FOR VARIOUS TRANSCONTINENTAL RAILWAYS.

| Name of Railway. | Highest Summits. | Maximum Gradient in feet per mile. Eastbound. | Westbound. | Total Ascent in feet overcome. Eastbound. | Westbound. |
|---|---|---|---|---|---|
| Grand Trunk Pacific | 1 Summit. | | | | |
| Western Division, Winnipeg to Prince Rupert. | 3,712 | 21 | 26 | 6,990 | 6,890 |
| Eastern Division, Winnipeg to Moncton. | | | 31 | | |
| Canadian Pacific | 2 Summits.<br>5,299<br>4,308 | 237 | 116 | 23,106 | 23,051 |
| Great Northern | 3 Summits.<br>5,202<br>4,146<br>3,375 | 116 | 116 | 19,987 | 15,305 |
| Northern Pacific | 3 Summits.<br>5,569<br>5,532<br>2,849 | 116 | 116 | 17,830 | 17,137 |
| Union Pacific System, Omaha to San Francisco. | 3 Summits.<br>8,247<br>7,017<br>5,631 | 116 | 105 | 18,575 | 17,552 |
| Omaha to Portland | 5 Summits.<br>8,247<br>6,953<br>3,537<br>3,936<br>4,204 | 106 | 116 | 18,171 | 17,171 |
| Santa Fe System | 6 Summits.<br>7,510<br>7,453<br>6,987<br>7,132<br>2,575<br>3,819 | 175 | 185 | 34,003 | 34,506 |

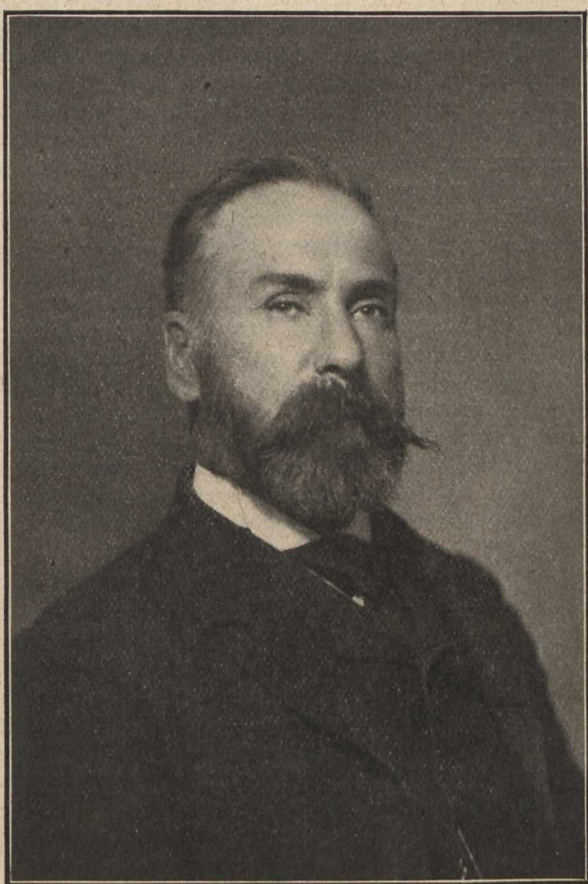
# THE CANADIAN WATERWAY TO THE ATLANTIC.*

By H. K. Wicksteed, C. E.

Although it is many years since the Georgian Bay Canal was first spoken of, it is astonishing how few, outside those interested in transportation, know anything about the project. The topic is of great interest, not only from an engineering, but from a romantic standpoint, and as for the commercial side of the question, probably no subject of equal importance has hitherto been discussed in Canada. Mr. H. K. Wicksteed, C. E., of the Canadian Northern Railway, is one of the pioneers of the scheme.

In a recent address before the Canadian Club of Montreal he gave his views on the project as follows:

"I am given the opportunity to address you upon a subject which a few years ago was very near to my heart. At that time I was not only the originator but the best authority on the topic of Georgian Bay navigation. Within the last three or four years extensive and tolerable exhaustive surveys have been made by the Federal Government,



H. K. Wicksteed, C. E.

and a great many people know more about it than I do, but I have noticed in conversation that few of our business men seem to grasp the full significance of the project and what it is intended to do for Canada, and more especially for Montreal. In the first place I have been repeatedly confronted with the proposition that modern railways have so far improved on their methods and management and so cheapened their rates that it is impossible for the canals to compete with them. This is true to a certain extent of the smaller canals, such as the Erie, the Rideau, etc., but it is not a small canal we are considering or proposing, not a canal at all, but the improvement of a natural waterway some 400 miles in extent on which there will be when completed only 30 miles or 7½% of canal, and on the balance of which the largest vessel now navigating the Great Lakes can steam along practicaly as fast and as comfortably as on the Great Lakes themselves.

* Address before the Canadian Club, Montreal, February 4th, 1906.

It is not, I think, generally understood that so far from the railways being able to compete with this kind of water carriage, the cheapening has gone on in much faster ratio in the case of the water carriage than on railways. Steady work and development under some of the greatest minds of the times and of the continent have resulted in 20 or 30 years in the reduction of the cost of land carriage by about 50%. In the same time the lake carriers have reduced their paying tariffs 80%, in other words the railways have about halved the remunerative rates and the vessels have in the same time reduced them to 1-5 of the original. The best railways can afford to haul certain classes of freight in large quantities and for a long distance for ½ to ⅓ of a cent per ton mile. The big ore and coal carriers can carry their loads of the commodities one thousand miles, at the rate of much less than one tenth of a cent per ton mile, less than one third of the most favorable railway rates. This disproportion is growing continually.

**U. S. Steel Industry and Water Routes.**

It is a fact well known to the expert that what has placed the United States in the lead, easily the first among nations as an iron and steel producer, is not the railway development, although that has helped a little, not the plenitude of cheap coal and cheaply mined ores of a good quality, although these were essential, not even the aggregation and segregation of enormous capital; the greatest factor in the enormous growth of the steel industry was the possibility of bringing Ohio coal and Minnesota iron ore together near the shores of Lake Erie at a cost which the railways could not approximate, and in enormous quantities. Out of 50 millions of tons of traffic passing through the Sault Ste Marie canals in 1905, some 35 millions were iron ore.

Now we in Canada are coming face to face with the same proposition. We have in the East, in Nova Scotia and Cape Breton, great deposits of coal, and we have along the north shore of Lake Superior and north of the Ottawa enormous deposits of iron ores. There exists a water route between the two. The problem which now confronts us is how to improve this route so as to bring these commodities to a common point where the ore can be smelted and manufactured at economical rates.

**Canada Must Get Into Line.**

As in the case of the American Steel industry it is quite on the cards that this carriage of ore and coal, or both may come to completely overshadow the grain traffic, which we have in the past been considering as the main problem in transportation that concerns us to solve and the solution of which is now so far on its way to completion. But the grain trade also demands a cheaper mode of transport than the railways can afford; from Port Arthur to Montreal is 1,000 miles by rail, and it is difficult to conceive how, with the most favorable gradients and alignment any railway can haul grain at less than ten cents per bushel, but it seems perfectly reasonable, judging from past experience that it should come by water in 7,000 ton cargoes for 3 cts or less by a 20-foot waterway.

In the second place I frequently meet with the proposition that in as much as 100 millions or so has been spent on the St. Lawrence route, it would be much more reasonable to go on improving this route so as to secure a 20-foot navigation.

**St. Lawrence Route Nearly Twice as Long.**

In answer to this I would point out that the St. Lawrence route is nearly 400 miles longer than the Ottawa; that the recent enlargement to 14 feet has cost a very large sum of money and a further enlargement to 20 feet would necessitate the deepening not only of the canals but of the river and lakes between for many miles and if not actually impracticable we should at any rate probably have more expenditure than would build the Ottawa Canal, and when completed we should have to travel 400 miles further, and through some 70 miles of actual canal and many more miles of excavated channel, while on the Ottawa route we should have only 30 miles of actual canal and a proportionately short extent of artificially deepened river channel. The Ottawa is a controllable river. Its level may be kept up and even its freshets controlled by dams of moderate cost. One now exists at Carillon, where the river has its greatest volume. And for many tens of miles it is possible to raise the level of the river and so secure greater depth and even drown out small rapids, without damage to riparian owners. While in the case of the St. Lawrence, not only is the river of great volume, but the question of riparian rights and damages confronts us at every town, and for many miles the question of interfering with the river becomes one not only of damage to Canadian land owners, but threatens to lead to international complications.

**Some Strategic Features.**

And here again we come to another argument for the Ottawa navigation as opposed to the St. Lawrence, an argument to which I have never been inclined to give much prominence myself, but which has been dwelt on by others. The St. Lawrence canals are nearly always close to and for some distance practically on the boundary line between ourselves and the United States. The Ottawa navigation approaches nowhere nearer than 45 or 50 miles.

In these days when business and commerce are our first consideration and paramount, we think little of the military or defensive side of the question. The day has not so long gone by, it may come again, when military point of view was of the greatest importnace. It dictated the construction of the Rideau Canal at a cost of $5,000,000, a very large sum for those days, and the same consideration warped the location of the Intercolonial Railway into the shape of a bow, of which it is now the purpose of the Transcontinental to build the cord.

A third point which I find the ordinary business man has not seen or has lost sight of is the magnitude of territory served and the trade more or less affected. It is looked on merely as a scheme for the relief of our Northwestern farmers. "Well," they say, "the North-West has been doing very well, and is settling up very fast, but the three great railways are pushing into it and spending great sums of money and surely they will be able to take care of the traffic for some years to come." True, but the railways' main object is to connect the North-West with Lake Superior, and the Ottawa Canal is projected to carry this traffic on from Lake Superior to the sea.

**Would Carry American Goods.**

Secondly the canal is not a project of interest merely to Canada, although it lies wholly in Canada. It may easily be that a few years will see a large portion of the traffic of the Canadian North-West finding an Eastern outlet via Hudson's Bay. Many of our keenest and shrewdest men believe firmly in the possibility—the commercial possibility—of shipping by this route, but there is still a large territory just as rich and more populous lying south of the boundary extending as far south as Denver and west to the Pacific coast which is much more keenly interested than our own country in a shorter and cheaper outlet to the seaboard. Fifteen years ago, when the agitation first became felt, it was a deputation from Minneapolis and St. Paul, not from Winnipeg which went to Ottawa to discuss possibilities. Writing at the same time in answer to a letter from myself, the late Mr. Wellington, editor of "Engineering News," thus expressed himself editorially in that paper: "We should be glad to do what we could to further so magnificent a project, but under present circumstances what is the use with one country (Canada) bearing the expense and another (the United States) reaping the chief benefit." And again he writes: "If the route lay in the United States territory the canal would long ago have been built and thrown open to the world as an international highway."

Circumstances have greatly changed since these words were written. The Canadian North-West has grown enormously in wealth and population, and the American West

**Demand is for Better Waterways.**

to such an extent that the pressure of population has come to be felt. The export of wheat has increased correspondingly. Many schemes have been formulated to effect a reduction in freight rates, and some of them partially carried through, notably the improvement of the New York State canals, and we have much more recently a proposition for a 14-foot waterway via the Illinois and Mississippi Rivers from Chicago to the Gulf of Mexico, which, however, has not been very favorably reported on.

It will be noticed that all these agitations and demands are for the enlargement of waterways not for State-owned railways. All these are summer routes only and open to the same objection that has been so often made to the St. Lawrence route and still more to the Hudson's Bay route, that they are available only for a part of the year. As a matter of fact the Sault Ste Marie canal with its enormous traffic must be an integral part of any of them and when it is closed their usefulness would be largely gone. Hence any route that can be kept open as long as the Soo. is quite good enough for the purpose.

**Water Powers Along the Ottawa.**

Another change in conditions which has taken place in the last 15 years and which has a great bearing upon the Ottawa Canal scheme is the increasing extent to which water power is being used as a substitute for steam. The canalization of the Ottawa and French Rivers would place under control power which has been estimated as high as three million horse power. Taking the conservative estimate of one million horse power, and allowing only $5.00 per h. p. per annum as the value, and we have a net income of five millions of dollars, which, at 4% represents the interest on one hundred and twenty-five millions. Add at least as much more on the tributaries of the Ottawa, the Gatineau, Coulonge, Petewawa, DuMoine and Keepawa, and we have in conjunction with the cheapest of transportation by water both to the seaboard on the east and the centre of the continent on the west, sufficient reason for the dvelopment of the Ottawa valley into the most attractive manufacturing district on the continent if not in the world; and there are many other resources in the Ottawa valley and contiguous country, commodities such as marble, phosphate of lime, feldspar, graphite, etc., which cannot bear the expense of a long journey, but which would become immensely valuable if cheap water transportation were available. So much for the raison d'être of the proposed navigation, for its justification.

**Lots Left for Railways.**

I have endeavored to show, first that there is a real demand for it or something equivalent. Second, that this demand comes not only or even mainly from the people of Canada, but even more from the United States, and third, that it may be expected to do what the railways cannot do and will not be a competitor with them. On the contrary, the Ottawa Valley, which will provide much more traffic for the railways, of a remunerative character, than it can possibly take away. As a case in point, the greatest financial railway success in the world, at any rate up to the last four or five years, is the New York Central, built for its entire length parallel to and close alongside of the then greatest waterway of the country, the Erie Canal. The canal built up a dozen large cities and towns and the railway draws traffic from them. And as to the proposition that the canal will serve American needs more than Canadian, I would say let it do so, especially if Canadian needs alone are sufficient warrant for the expenditure, as I think they are.

It can do us no harm to have the commerce of the American West sailing past our doors. It can do no harm to Montreal and Quebec particularly to have this commerce transhipped in their harbors, and it can do no harm, especially in a political sense, to have the canal controlling the main gateway of the commerce of half of the North American Continent.

**Its Past History Raked Up.**

Having briefly discussed these questions of political or rather commercial economy, I will try to give in a few words the history of the project and why it has come to be considered the best solution of a great problem. A great many centuries ago when the land to the south of Lake Huron and Michigan was relatively higher than it now is, the lake evidently discharged via. the Ottawa River.

Old terraces and beaches parallel to the river at many points seem to imply that a river of much greater volume than the present Ottawa once occupied its valley and that of Lake Nipissing and the French River, which as you will see by the diagram above is continuous with the former.

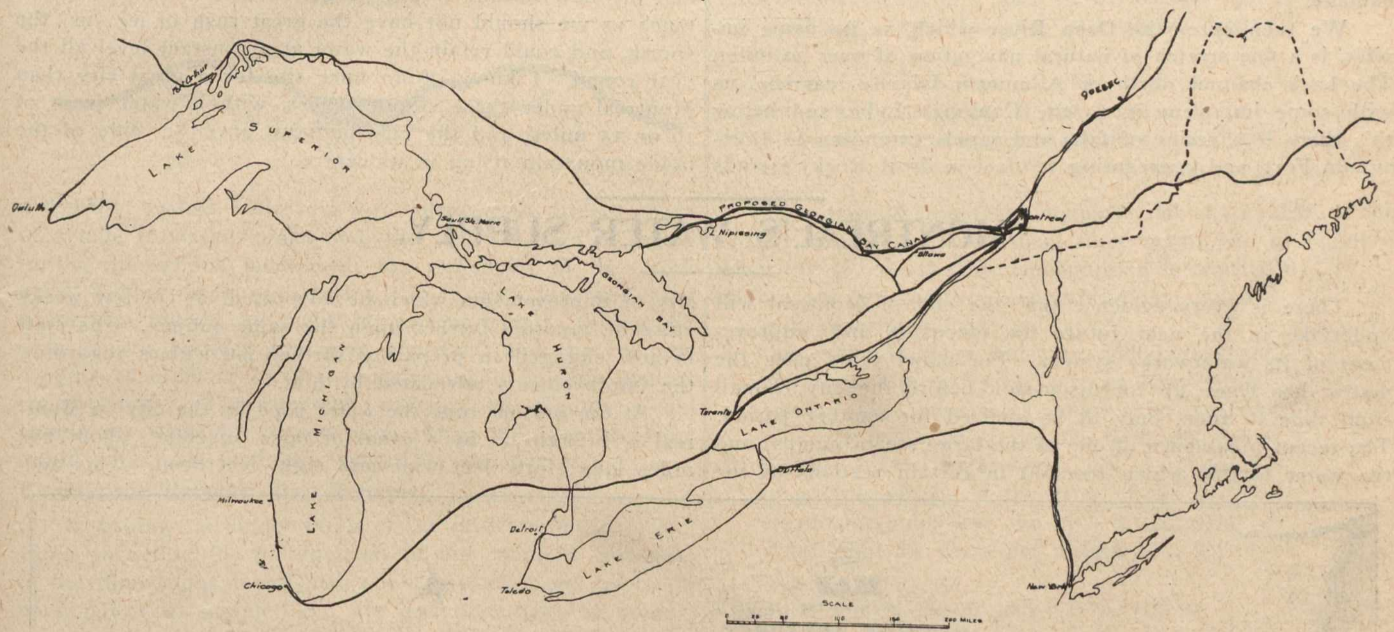
The change in level has not been very great, for even now Lake Nipissing is only a little over 60 ft. above the Georgian Bay. And the Mattawa a few miles further east is below it, but it was sufficient to send the St. Lawrence, or whatever the prehistoric man called the river, hundreds of miles out of its course to reach the ocean, first via the Mississippi, by the valley of the Illinois and later via Lake Erie and Niagara Falls, into Lake Ontario, so that the present project is merely one to restore the original conditions as far as navigation is concerned.

**Romance of the Ottawa.**

Coming down to historic times we find Champlain, nearly 300 years ago hearing from the Indians of the Ottawa Valley, of the great fresh water sea, and eventually going with them to see it, by this selfsame route. Until only a half a century or so ago it remained the recognized route to the upper three of the Great Lakes, and French fur traders by it penetrated to the "Soo" and Lake Superior. Twenty years before Hennepin saw Niagara, Jolliette, La Salle and Marquette all came in this way to the Mississippi, and the Hudson's Bay and Northwest Companies used it as a regular highway for a century or more. It was not until the railways reached Sarnia and Collingwood and steamers commenced to ply on the upper Lakes that the old route fell into desuetude and even then not for very long. Our first transcontinental railway took almost as a matter of course a route following it very closely, and while local topography dictated sharp pitches of steep gradients at sundry points, it still remains, even considered as a portage railway from the Great Lakes to the sea, that crossing the lowest summit and most capable of the highest development as a low-grade railway for handling freight. Nearly half a century ago, a survey was made for a barge canal, and reports made on the possibilities by two eminent engineers, Thos Keffer and T. C. Clarke, of New York. The estimates were for a nine foot draught of water and were for the present day very moderate, from twelve to fifteen millions of dollars.

**The Subject from its Infancy.**

The lowest portion of the system east of Ottawa was carried though to completion and has been for many years one of the busiest of our waterways, carrying enormous quantities of lumber to the New York market. Some little work was done higher up the river, but the commerce of the Great Lakes had hardly begun to develop. our Canadian North-West was almost a terra incognita. All the settlement had followed the milder climate and more fertile lands of Western Ontario, and not unnaturally such money as was available was spent in improving and developing the St. Lawrence route. Only the lumbermen were interested in the Ottawa, and 50 years ago they had not penetrated much beyond Pembroke. It was, if I remember rightly, in 1890, when the C. P. R. had begun to operate successfully and regularly, and when attention began to be turned to the North-Western prairies that the Government of the day was urged to subsidize the Hudson Bay Railway as a shorter outlet to the ocean than that via Montreal and the St. Lawrence, and it was then that as a matter of technical interest I began to study the possibilities of a ship canal as a competitor to the proposed route, and finding that my figures and calculations made a very favorable showing as to comparative economy I wrote a series of letters to one of the leading dailies which were very favorably received and commented upon, but, as I pointed out before, the greatest interest was displayed by citizens of the United States in Toledo, Chicago, St. Paul and Minneapolis. Mr. McLeod Stewart, an ex-Mayor of Ottawa, worked indefatigably to interest the Government and the City of Montreal, and through them English capitalists, but with only partial success and possibly at the same time the scheme may have been with justice considered as too great for the times, but it has never been lost sight of and the phenomenal development of our North-West in the last five years, as well as the foundation of two great steel companies have put an altogether new face upon the matter.




Map Showing Proposed Georgian Bay Canal.

An expenditure of fifty millions 15 years ago seemed a much more tremendous thing than does one of 100 millions to-day, and while no official estimate has been given to the public, I believe that 100 millions is amply sufficient to provide a 21 foot navigation from Georgian Bay to Montreal, and that unquestionably there is in sight a magnificent return for the expenditure.

**Description of the Route.**

To describe the route, commencing at the west end, we enter the middle or main branch of the French River at Copananing through a channel generally wide and open, and having at least a natural depth of 18 feet. The French River is called a river by courtesy, because it carries off the water of Lake Nipissing. Strictly speaking there is barely a mile of it which can properly be called a river. It carries no sediment, and no part of its channel has been cut by itself. It is a series of lakes generally of great depth and ample width, with short rapids and falls between, and its total fall is only a little over one foot to the mile. Its banks are almost invariably steep rock, and its natural channel navigable for miles at a time by the largest vessels without improvement. Three locks are proposed to overcome the lift to Lake Nipissing, and several dams to raise the water and prevent its flowing by secondary outlets into the Georgian Bay. Excavation is almost entirely confined to the immediate neighborhood of the locks themselves.

**Lake Nipissing Would be High Point.**

Lake Nipissing is one of our great lakes. On the line of navigation it will be some 30 miles across. The water is deep and bold near outlet, but shoals towards the east, where considerable dredging in sand will be necessary. From Lake Nipissing across the divide or watershed to Trout Lake, the first of the Mattawa chain draining into the Ottawa is 4 miles, and Trout Lake is 25 feet higher. The original proposition was to raise Lake Nipissing to this level by means of a dam at its outlet. This plan has now become impracticable owing to the construction of the C. P. R. and other vested interests, and the accepted plan now is to lower Trout Lake to the level of Lake Nipissing when at its highest, at which level it would be held by a dam. The former Trout Lake is fortunately very deep, and but little of its length would have to be deepened. The summit cutting would be some five miles long with a maximum depth of 50 feet, and almost entirely, as far as our information goes, in earth. Lake Nipissing would thus become the summit level and supply for lockage in both directions.

**Long Stretches of Deep Water.**

The canalization of the Mattawa and the upper Ottawa as far as Deux Joachims is merely a question of detail. The Ottawa flows in a deep valley with rocky walls, and can be dammed into slack water pools, with comparatively little damage.

We then enter the Deep River which, as its name implies, is a fine stretch of natural navigation of over 30 miles. The back channel north of Allumette Islands carries us with some impovement, to the Coulonge Lake, and below this there is a series of falls and rapids extending to Portage du Fort, and aggregating 100 feet in drop. Rocky islands and side channels assist considerably the construction of locks and dams. From Portage du Fort there extends a long stretch of 30 miles with only one small rapid, known as the Cheneaux or colloquially "Snows," which brings us to the head of the Chats Falls, a remarkable pitch through an archipelago of islands. At extreme high water there are said to be over 20 distinct channels. The interruption extends some thee miles, and then ensues another fine lake, the Duchesne or Aylmer Lake, extending 25 miles. The rock has hitherto been laurentian almost exclusively, but the river now enters a limestone region and becomes a river of ordinary character, and with characteristics known to most of you. From Lac. Deschenes to Ottawa, some seven miles, there are several rapids and falls aggregating 60 feet, and then we have a 60-mile reach now navigable for light draught steamers and much of it needing no improvement. From Grenville to Carillon is 12 miles, with another drop of 60 feet, the canalization of which offers no unusual difficulty, and we then have the fine stretch on the Lake of Two Mountains, some 30 miles long. The existing navigation enters the St. Lawrence at St. Anne. The new proposal,

**New Harbor Back of Montreal.**

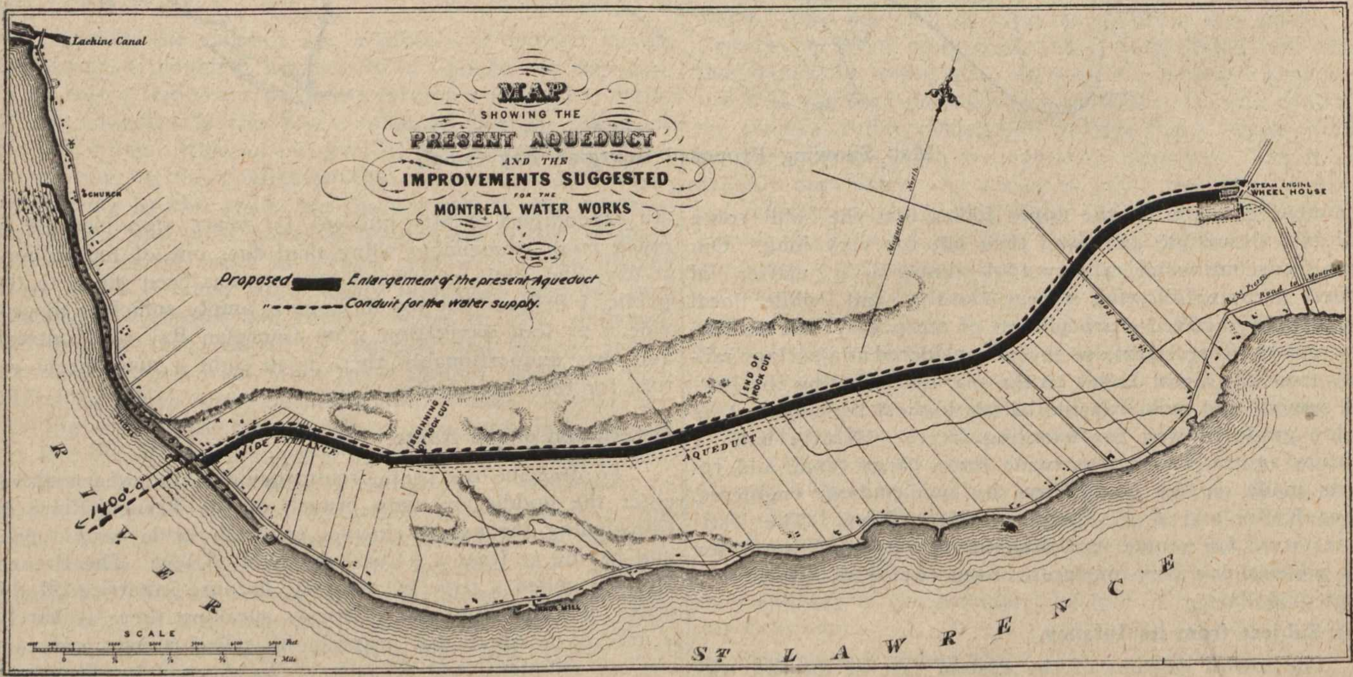
and a most interesting one to Montreal, is to use the Back River or Riviere des Prairies. By doing this we should not only shorten the distance to the sea and avoid expensive work in deepening the Lachine Canal, but we should create a great slack water basin behind Montreal and give it, like New York, a double frontage with a harbor on each front, and the new harbor would be better than the old, in so much as we should not have the great rush of ice in the spring, and could retain the water at a constant level all the year round. I know of no finer site for a great city than Montreal under these circumstances, with a water front of 10 or 15 miles, and the city built up on either side of the noble mountain rising in its centre.

# MONTREAL'S WATER SUPPLY.

There is every evidence that the city of Montreal will undertake in the near future the extension and improvement of its waterworks system. For many years past the matter has come up for discussion before the city council from time to time, only to be shelved for another period. The recent breakdown of one of the large steam pumps, and the water famine which resulted in certain sections of the city, has aroused much indignation, and led to a full discussion of the subject by the council. Another influence was unquestionably the attitude of the insurance underwriters, who advanced fire insurance rates very materiallv because of the state of affairs.

Mr. Janin, superintendent of the waterworks department, has often reported to the council regarding the necessity of improvements which he advocated, and a few weeks since he reported further upon the same subject. His staff is now engaged in preparing further particulars regarding the improvements advocated by him.

At the present time the water used by the city of Montreal is brought in by a canal or open aqueduct, about five miles long, forty feet wide and eight feet deep. This aqueduct taps the St. Lawrence River some distance above the Lachine Rapids, and the fall in the aqueduct from the river to the pumping station is between three and four feet.



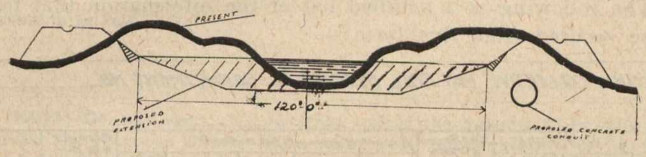

Both steam and water power are made use of at the station for the purpose of raising the water to the city reservoirs. A drop of some fifteen feet at the station gives the necessary conditions to develop the waterpower, and the waste water flows back into the St. Lawrence a short distance away.

The maximum quantity of water pumped by both methods is 35,000,000 gallons per day, the average requirements, however, being considerably below that quantity. The consumption of water in the city is increasing very rapidly, and it will not be long before a larger supply will be needed than can be economically provided by the present conduit, and, as it is also well to have access to more than one means of bringing water to the city in case of accident, the waterworks problem at present embraces not only the improvement of the channel of supply, but also of the means of pumping.

**Proposed Improvements to System.**

Mr. Janin proposes to lay down a concrete conduit, with a diameter of about eight feet, and walls six inches thick, alongside the present aqueduct, this new conduit to have a capacity of about 50,000,000 gallons per day. The new conduit would be placed underground, and the water would thus be brought from the river without being contaminated en route. The profile maps show that the slope would be one foot in 5,000 feet, and that for part of the distance the work would not be interfered with by rock, while a portion of the distance as much as eight or more feet would have to be cut through. After the conduit has been made available for supplying water, it is proposed to increase the size of the present aqueduct, giving it a width of 140 feet and

CROSS SECTION of PROPOSED NEW AQUEDUCT




a depth of 14 feet. Already, for a distance of three-quarters of a mile from the intake end, the size has been increased to the dimensions mentioned, the remainder of the work never having been undertaken. It is also proposed that connection should be made at various points throughout their length between the open aqueduct and the concrete conduit, in order to facilitate repairs and to provide against contingencies. The concrete underground conduit would supply the water for consumption, while the open aqueduct would supply the hydraulic power for the pumps.

**Comparison Between Two Systems.**

In urging the undertaking of the projects outlined, Mr. Janin says that the enlargement of the canal or aqueduct to the dimensions mentioned would provide 5,000 hydraulic horse-power in summer and not less than 2,000 in winter, when the water is low, whereas the present aqueduct only provides 500 horse-power. By means of the present supply about 14,000,000 gallons per day are being raised to the reservoirs in summer and only two or three millions per day in mid-winter, as the supply of water is then very light. Besides this, of course, the aqueduct supplies the water, which is pumped up by the steam pumps, to complete the balance of the requirements for consumption. Naturally, the water-power pumps are now used as long as the water can be spared, the cost of hydraulic pumping being only a small fraction of that by steam.

"The construction of this lateral conduit must be the first work undertaken; that is, it must at least be completed between the pumping station and the lower end of the portion of the now widened aqueduct, so as to assure a water supply for the pumps," says Mr. Janin. The plans, etc., can all be ready within three weeks from the time the order is given to go ahead. If the council acts promptly, he thinks the conduit can be finished before the winter sets in. This would add sufficiently to the water-power to enable the pumping of nearly three million gallons more by the water wheels. In the spring of 1908 the enlargement of the present aqueduct could be proceeded with, and the water supply could thus be adequately provided for within three or four years at most.

When completed, the entire work of pumping the water to the reservoirs can be accomplished by water-power, effecting an enormous saving. The following table shows the quantity of water pumped from this station, the methods employed, and the cost of each:—

| Year. | Gallons pumped. | Power employed. | Cost. |
|---|---|---|---|
| 1903 | 3,713,220,951 | Water | $ 5,277 |
| 1903 | 5,257,151,653 | Steam | 50,947 |
| | 8,970,372,604 | | $56,224 |
| 1904 | 3,616,150,841 | Water | $ 4,600 |
| 1904 | 6,527,887,166 | Steam | 63,975 |
| | 10,144,038,007 | | $73,575 |
| 1905 | 3,076,348,752 | Water | $ 5,364 |
| 1905 | 7,939,510,094 | Steam | 88,083 |
| | 11,015,858,846 | | $93,447 |
| 1906 | 13,000,000,000 (est.) | Both (est.) | $113,000 |

**Cost of Proposed Improvements.**

The cost of the proposed improvements is estimated by Mr. Janin at $2,132,000, divided as follows:—

| | |
|---|---|
| Lateral conduit in reinforced concrete to discharge 50,000,000 gallons daily | $ 660,000 |
| Suction well for pumps at lower end of conduit | 20,000 |
| Extending the conduit out into the St. Lawrence by means of two pipes, with intake pier | 75,000 |
| Excavations (sections 2 and 3), dry stone walls, puddling, farm bridges, stop-gates, fences, etc. | 817,000 |
| Purchase of land, section 3, 20 arp, at $1,000 | 20,000 |
| Widening and deepening of tail race | 45,000 |
| Wheel-house, new pumping machinery, buildings, etc. | 300,000 |

(The cost of new force mains is not chargeable to the project, for, in any case, these force mains will be required when the 50,000,000 daily consumption is reached.)

| | |
|---|---|
| Unforeseen expenditure, expropriations, surveying, superintendence, etc. | 100,000 |
| To this estimate there must be added, however, the time the carrying out of the work would take, say, three years, the cost of pumping by steam power, the water at present pumped by the water-wheel, viz., 3,616,000,000 of gallons yearly, at the price of the cost for steam pumping, less the cost of pumping by water, that is, $8.75 per million × 3, say | 95,000 |
| The total cost of the project would then be | $2,132,000 |

Interest on the above at 4 per cent. per annum would amount to $85,280 per annum.

**Saving Effected by the Proposition.**

It is interesting to note, however, that the building of the proposed conduit and its extension 1,400 feet out into the river, by ensuring a supply of water which is practically pure, would do away with the expense of providing a settling basin, for which a clamor is being made from time to time. The establishing of this settling or filtration plant would cost not less than $800,000, and its up-keep would be $36,000 per year, so that these two items alone would reduce the additional cost incurred for the new works to a very small figure.

Leaving the question of the filtration plant out of consideration, a saving of at least $75,000 per year would be effected by pumping by water instead of by steam. There would also be sufficient water-power to supply electric power for lighting and other purposes, effecting a revenue of $10,000 per annum, besides which there would be a surplus of 1,500 hydraulic horse-power, which could easily be sold at $5 per horse-power, or $7,500 per annum.

Notwithstanding the fact that immediate action in the matter is imperative, and that such action could be taken, as shown, without any ultimate additional annual cost to the city, Mr. Janin, when seen by the representative of the "Canadian Engineer," was by no means sanguine as to results. "Yes," he said, "it should be done immediately; it should have been done years ago, and perhaps it will not be done for years to come. Matters of this nature sometimes move very slowly."

Mr. Janin urged the council to get a report from two competent engineers, who had not previously been employed upon the scheme, in order to get as unbiased an opinion as possible upon the effectiveness of his proposal. Messrs. John Kennedy and Ernest Marceau, civil engineers, have been appointed for this purpose, and there seems to be every probability, at the present, that the work will be begun this spring. The new city bill empowers the council to raise the funds, so that the financial end of the proposition no longer stands in the way.

# SYSTEM IN INDUSTRIAL ESTABLISHMENTS.

By A. J. Lavoie.



XIII.

## Semi-monthly Pay-roll Record.

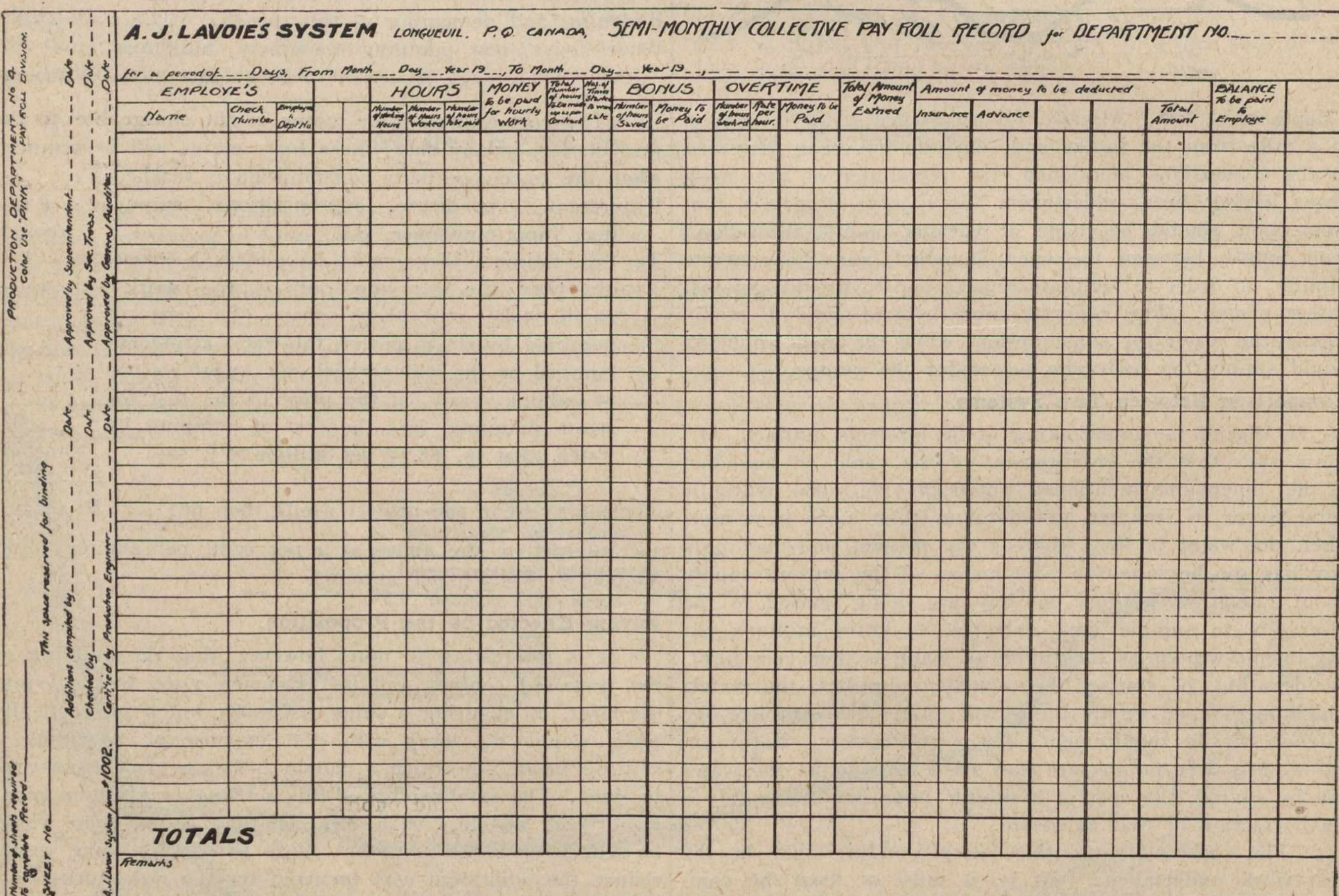
The mode of paying employees is a question that has led to much discussion. Opinions vary as to whether it is best to pay them by the day, week, half-month, or month. Most employers pay their employees semi-monthly, and the writer is of opinion that this system is by far the best, since it saves considerable work on the part of the clerical staff, and at the same time affords the employees an opportunity to accumulate a small amount of money.

In an establishment known to the writer, where about three hundred employees are on the staff, they were paid weekly, and every week advances were made on the wages. A savings bank, which was but a block away, received no deposits from the workmen worth speaking of. After a short time the system was changed, the employees being paid semi-monthly. The results which followed were almost phenomenal, at least one-fifth of those employed having opened a savings account at the bank, which shows that through the longer period between pay-days, by which the employee receives a larger amount, they were enabled to place a certain percentage of their wages in the bank each pay-day. Some of the employees became so saving that, rather than withdraw money from the bank when required, they would ask for an advance in wages.

A longer period than this between pay-days has a tendency to lead employees to abuse the borrowing habit, since there are many men who cannot conveniently wait such a long time for their wages. For these reasons the semi-monthly pay-day has been adopted in the Lavoie System, and the semi-monthly pay-roll record form No. 1002 is used for all departments of both productive and non-productive labor.

### Advantages of Form No. 1002.

This form will be found so advantageous that it should be used in even the smallest establishment. The record of departmental labor may be kept in any arrangement desired, while the form also gives information which will enable accurate costs of each department to be determined. The following is a detailed list of the information that may be secured from this form:—




The Actual Size of this Form is 18 x 12 Inches.

1. Number of working hours.
2. Number of hours worked.
3. Number of hours paid for day work.
4. Amount of money paid for day work.
5. Number of hours to be made as per contract.
6. Number of times the employees have started work late.
7. Number of hours saved by the bonus system.
8. Money paid for bonus.
9. Number of hours worked overtime.

10. Amount of money paid for overtime.
11. Total amount of money earned by the employees.
12. Amount of money paid for insurance.
13. Amount of money paid in advance on wages.
14. Blank spaces for special items.
15. Total of advances to be deducted from the amount of money earned by the employees.
16. Balance of money to be paid to the employees.
17. Number of employees in each department, both productive and non-productive.

From these items it will be seen that the record is very complete, giving as it does detailed information regarding the wages problem of the establishment. By it the labor expense of each department, or section thereof, may be determined accurately. Enough information is contained therein to enable graphic diagrams to be made.

### The Making of Form No. 1002.

This is done by copying from the individual employee's pay-roll record, Form No. 1001 (already explained in the March issue). Then it is only necessary to add up the different columns, putting the totals on the bottom line.

Form No. 1002 is prepared by the pay-roll section in Department No. 4. There must be two sets of forms, made

| Employe's Check No. | In Department No. | Pay Ending, Month, Day, Year |
|---|---|---|
| | | |

Name of Employe

Amount to be Paid

**NOTE—Do not open this envelope unless the amount to be paid is correct. If you open this envelope, count your money immediately before leaving the establishment.**

**In case of trouble, keep your mouth shut, and take the matter up at once with the paymaster. Remember you are not the only one that makes mistakes.**

A. J. LAVOIE'S SYSTEM, FORM NUMBER 1003. PAY ENVELOPE.

Printed light blue on 20 lbs. manilla envelopes Size of envelope 2½ in. x 4½ in

in duplicate; one set for the non-productive labor, and one set for the productive labor. After the preparation of these sheets they must be approved by those whose signatures are called for on the form.

### A Money Order.

Form No. 1002 also acts as a requisition for the wages to the secretary-treasurer, showing as it does the amounts required to fill the pay envelopes of the employees. Practice has shown it to be advantageous to have the pay envelopes of any industrial establishment filled by the bank, since this method saves a considerable amount of work on the part of the office staff, which very often is not as competent in the handling of money as the bank staff. It also avoids the neglect of department routine. The banks only charge a small fee for this class of work, which is very nominal when compared to what it would cost if done in the office.

When this system is adopted the secretary-treasurer transfers the original pay-roll records, form No. 1002 (after approval to the bank, where they will be used for the purpose of checking the pay envelopes.

### Pay Envelopes.

While the original form No. 1002 is being sent round for approval the duplicate copies are kept by the pay-roll division in department No. 4, where they are used in preparing the pay envelopes, form No. 1003. When these are prepared they are at once delivered to the bank, to be filled as per amounts marked thereon. The bank officials will then compare the amounts on said envelopes with the original form No. 1002, in this way making sure that no false pays have been prepared, and also avoiding any possibility of errors. After being checked the envelopes are filed and kept in a vault until a written order is received from the secretary-treasurer, approved by the general auditor, to deliver the pay envelopes to the paymaster. Upon delivery of the envelopes the bank officials will return the original copy of form No. 1002 to the general auditor for filing purposes.

### Pay Envelope Receipt.

The receipts for the pay envelopes, form No. 1004, are also prepared from the duplicate copies of form No. 1002 immediately upon completion of the pay envelopes. These may also be prepared from the individual employee's pay-roll record, form No. 1001. When completed the receipts are sorted according to departments, and temporarily filed in the pay-roll division of department No. 4 until the morning of the pay-day, on which day they are to be kept in readiness, and when the head foreman of each department comes into work in the morning he takes the receipts for his department, and delivers same to each employee during the forenoon. Any receipts not delivered must be returned to the timekeeper's office before noon.

### Employee's Signature.

Each employee has to verify the amount shown on his receipt, and sign his name and number if found correct. When being paid the employee presents his receipt on top

| Employe's Check No. | In Department No. | Pay Ending, Month, Day, Year |
|---|---|---|
| | | |

| Name of Employe | Signed by Employe—See Note |
|---|---|
| | |

| Money Earned | Amount to be Deducted | Balance to be Paid |
|---|---|---|
| | | |

**NOTE—Do not sign this receipt unless the amount to be paid is correct, as no claims will be allowed afterwards.**

**All complaints to be made in writing on back of this sheet, and addressed to the Paymaster.**

**Any erasure or alteration will render this receipt valueless.**

**This receipt and daily Time Card (after approval) to be exchanged for your PAY ENVELOPE, at the exit of the establishment, at noon time.**

**KEEP THIS RECEIPT CLEAN.**

A. J. LAVOIE'S SYSTEM, FORM NUMBER 1004. PAY ENVELOPE RECEIPT.

Printed light blue on 20 lbs. pink color bond paper. Size of form 3 in. x 5 in.

of his time card, form No. 119-120, at the exit from the works. By this method the employee identifies himself, and there is no opportunity for one employee to get the pay of another.

The receipts are then filed with all the time cards used by each employee. They are then transferred to the record department for future reference.

Form No. 1002 will be dealt with finally in the next article.

(To be continued.)

## CEMENT AND CONCRETE.

The seventh number of the "Canadian Cement and Concrete Review" is better than the last issue, if that were possible. The journal should be in the hands of every one interested in the cement and concrete industry. It is the only paper of its kind published in Canada, and is keeping pace with the marvellous development of reinforced concrete construction in the Dominion. A most interesting statement as to Portland cement production in Canada appears in the latest issue. There is also an article specially written for the paper on reinforced concrete failures, and the fourth instalment of an interesting description of the cement industry of Ontario. The paper is edited in a way that makes it equally useful to the practical and the technical man, and to those who are interested in the industry, though not in its technicalities. It is produced on fine art paper, and is a model trade magazine. The payment of a dollar per annum in exchange for this journal is certainly a cheap and effective method of keeping in touch with this rapidly growing industry in Canada. We are informed that specimen copies can be obtained on application to the publishing office, 18 Court Street, Toronto.

# STEEL RAILS.

By T. S. Griffiths.*

To those interested in railway work, it is a well-known fact that the steel rail manufactured at the present day has been a matter of great discussion—more especially on account of the many failures that have occurred, causing disastrous wrecks.

Frequently the question has been asked by the engineers of the various railways, why rails manufactured to-day have not the lasting qualities and other essentials of rails that were manufactured ten or twelve years ago.

To those who are familiar with the steel business and allied interests it must be admitted that great advancements have been made, even in the last ten years, in the volume of business, and that works not only in the United States, Great Britain and the Continent, have greatly increased in size—and still for all this, even with our own Canadian industries at Sydney and Sault Ste. Marie, the capacity is insufficient to take care of the business that is now offering. Every possible effort is being made to make improvements in the step of the manufacture, to meet the requirements of increased demand.

When we look at the tonnages—or rather the outputs of the various rail mills to-day, compared with the outputs of some years ago, the tonnage is more than trebled, and in some of the mills in the United States quadrupled.

The condition of rail manufacture has reached a point that starting with the steam shovel which loads the steel cars at the ore mines, there is no break in the continuous movement until the finished rail made from this ore is loaded on cars ready for shipment.

In explanation I would state that the cars are filled with the ore at the ore mines, from whence they are transferred to the docks and there dumped into the hold of the largest capacity steamers—this loading being conducted automatically—a much quicker way than the old method of loading. Then again, the steamers in turn bring it down the lakes to other docks, where it is automatically unloaded, and transferred to other cars. These cars then convey the ore to the ore yards and bins, when it is again automatically unloaded, and thence carried to the blast furnaces. From the blast furnaces, where years ago the molten pig iron was allowed to run into pigs and then allowed to cool before charging in converter, this molten pig iron is now run direct into ladles and transferred to a mixer or large tank, which acts as a storage, and which is kept under constant heat.

As often as necessary the converting vessels are run to the storage tank to receive the supply of hot metal, which is then returned to the converting mill and converted into steel as required.

From the converter or open-hearth furnace, when the steel is sufficiently blown or heated, the same is cast into ingots. These ingots are not allowed to cool generally, but are turned rapidly into blooms, and then rolled into the finished rail section.

At various points the product is either placed in soaking pits to add the necessary amount of heat, or kept in heated tunnels to prevent the loss of heat—the object being to lose as few heat units as possible from the time the pig iron is tapped from the blast furnace until it is made into steel, and finally turned into the steel rail section.

Usually at no stage is the material allowed to become entirely cold, and the molecules to come to a state of equilibrium.

It is contended by many metallurgists that steel made in this manner is not the equal in quality to steel made by a process where the steel in different forms is allowed to become wholly cool, and is then re-heated for the subsequent process.

This last method, of course, takes a greater number of heat units, more fuel, more time, and cuts down the tonnage output of any mill.

Moreover, the methods of rolling have materially changed during the last ten years. There has been much study, with resulting improvement in the shape and form of the different roll passes whereby a bloom can be reduced to the rail section with a much less number of passes than formerly.

It is claimed by some investigators that this reduction in the number of passes, combined with the lack of re-heating, has produced a steel which is coarser in structure, and, therefore, of poorer wearing quality, as compared with the rail made with the greater number of passes some years ago. In other words, the rail of to-day is made with the least amount of work, or rolling, so as to keep up with the heavy demands, and produce increased tonnage.

The rail of to-day compared with the rail made some years ago with the proper amount of working and re-heating gives the same external appearance, and both may conform to the same chemical analysis.

At one mill in the United States a continuous mill was formerly used for rolling rails, which caused a question as to whether rails rolled in the same direction, that is to say, continuous from pass to pass in the various housings, was as good as rails rolled in a mill of three high rolls, where the shape was inserted through the bottom roll, and returned to the top roll, and this process continued until the required section was produced.

By the continuous method of rolling the rail was drawn like wire or cold rolled shafting, so that one can readily see that under the process of three high rollings and reversing the direction of the rolling through the different passes more satisfactory results could be obtained, as the same has a bearing on the structure of the steel.

This continuous method has been abandoned and the proper method of three high rolling resorted to—which gives a much better wearing rail than produced by the continuous process operated under the increased tonnage.

It has been frequently considered by engineers of the various railways as to whether or not a large percentage of the rails to-day meet the specifications of the purchaser, still in most of the investigations that have been made the chemical properties of the steel—and even drop tests—have proved satisfactory.

The fault is not altogether on the manufacturer, but seems to lie in the specification—which does not fully restrict the manufacturer to a standard method of rolling and re-heating.

Frequently the engineer of the railway, subject to the dictates of the management of the railway possibly interested in the affairs of the steel company, and also on account of the urgent need of having a certain mileage of tracks laid by a certain time, allows the manufacturer to give them what is called "a commercial product" that fills the specification prescribed, regardless to restrictions as to the working of the steel to produce the rails.

In the States the largest patronizers of the railways are the steel manufacturers; and frequently the steel manufacturers operate railways, which convey their material to the different points.

On account of the heavy demand and the urgent need of delivery by the various railway corporations, the mills are doing their best to furnish the best commercial product that will fill the requirements of the average specification.

Frequently it has been mentioned by various engineers that the specification should be re-modelled and restrictions as to rolling and heating be enforced, but due to the fact that the larger percentage of the buyers of steel rails have agreed to accept the standard specification to which their mills generally are working—it could hardly be expected that these steel mills would accept an order to an occasional specification made with rigid restrictions; as we know the tendency on the part of the rolling mills as dictated by good business is to get all the different railways to adopt a uniform section of rail conforming to the American Society of Civil Engineers' Standard, so as to cut down the num-

*President, Canadian Inspection Co., Limited.

ber of different rail sections, and thereby make their equipment of machinery, rolls, etc., interchangeable.

This should also apply to specifications, and if the railroad companies desire a harder, tougher and better rail there will have to be a concerted action amongst all railroads, and this action could be taken up with the rolling mills so that all points of manufacture would be thoroughly agreed upon and if necessary have them pay an additional price for the rolling mills to furnish a better quality of rail. I say a better quality of rail, because with the increased weight of locomotives and size of cars, together with the heavier rail sections, it would seem a better quality of steel should be used.

The railroads are not in a position to ask the rail mills to give this without being willing on their part to pay for such a rail, and I feel the direction along which the mills should work should be for a harder and tougher rail, one which is perceptibly low in phosphorus, slightly high in carbon and high in silicon, to give toughness.

This is one objection to the Bessemer process in the manufacture of the heavy rail sections on account of the phosphorus and sulphur elements being high, which with an increase of carbon produces very brittle material.

By the open-hearth process these elements of sulphur and phosphorus can be considerably reduced, so that the carbon can be raised without any danger, and, as stated, the silicon and the manganese should be increased.

Certain roads in the States have used a rail as high as .75 carbon, one per cent. manganese, but they limit the phosphorus and sulphur not to exceed .05, or .06, with a silicon at .20. By keeping the phosphorus as low as .06, as compared with .10 to .12 in the usual rail, it was possible to raise the carbon to as high as .75, and by raising largely the silicon toughness was added and rails approximately of this composition have been known to bend 70 degrees without any signs of cracking.

Rails of these chemical proportions have to my knowledge been in service as long as 10 years without wearing out. Certain railroads buying rails of this sort pay a premium of several dollars per ton, and the premium was a most excellent investment, as the rails have undoubtedly run out at least two ordinary rails. Moreover, there has been the safety against breaking and wreck.

What may be considered a standard chemical specification for a good rail would be from, say .60 to .65 carbon. with .90 manganese, silicon .15, and phosphorus not to exceed .06. This would make a hard tough rail, and which should have the life of at least twice that of the ordinary rail bought to-day.

Of course, in making this rail the proper amount of working should be resorted to in the mills.

The cost of such a rail—at least the price asked by a rolling mill—would be several dollars higher than rails are commonly sold for to-day. The price would be very high for a single order, but if a concerted action amongst the various railways calling for a very large tonnage, the increased price would not probably be over $2.00 per ton.

It would be necessary in furnishing rails of this composition to use entirely different stock than that from which rails are made to-day. It would call for pig iron of low phosphorus and low sulphur, and would cost more than the pig iron of high phosphorus and sulphur, and further would require the steel companies to make and carry this grade in stock.

At the present time very few steel companies have material of this grade on hand, except those engaged in the manufacture of acid open-hearth steel. The objections against making rails out of basic open-hearth steel, which would fulfil all of the above concessions readily, and would permit of the use of a very much cheaper grade of stock, is that the capacity of the basic open-hearth furnace—more particularly in the United States—is not sufficient to meet anywhere like the demands for rails. The capacity is entirely absorbed by orders for structural steel boiler plate, etc.

Of course, if an individual railroad frames their own specification, and the specification is a rigid one, they either have to pay an excessive price for the rails, or their specifications are refused by the mills.

Another point to be considered, which demands that rails be of better quality, as prescribed by the foregoing chemical composition, is on account of the increased weight of locomotives, increased size and weight of cars, and further, on account of the heavier rail section.

And again, if a product of the prescribed chemical composition were acquired, the raw material would have to be selected, which would impede the progress of the mill and decrease the output.

It is nothing but fair that the manufacturer be compensated for this depreciation, if the railroad companies would appreciate the cost of replacing the rails on the track, to say nothing of wrecks, and secure a rail of much longer life, it would be very easy to figure out the amount they could afford to pay in advance of the present price of rails. To obtain this superior rail, and the saving I believe would be far in excess of the price the mill would ask for such a rail.

The rail to-day, while it meets the specification of the railroad companies, has been shown by certain investigators to be inferior in structure to that of the rail of 10 years ago.

Microscopical photographs of sections have conclusively proved this; moreover, certain roads have stated that they have in their tracks, rails which were made 8 or 10 years ago still in service, while they have replaced other tracks having no greater traffic (but which contained rails that were of more recent make) with new rails.

There have been complaints by certain prominent roads in the West, of heavy section rails breaking, and that the analysis of the broken rails conformed to the specification.

This points conclusively to the need of a better quality of steel, which is harder and tougher, and also undoubtedly a change in the method of manufacture, which would give a finer grain, and tougher than the rail which is now being made, and which the railroads speak of as having too short a life.

As regards the section of the rail, the chief thing necessary, in order to obtain the toughness and surface, will be to have the different parts of the rail about the same temperature throughout the rolling, and to continue the working of the metal until the mass is near a critical temperature, and at about a dull red heat.

In the rolling of steel rails there are two temperatures that can be termed critical—the higher temperature of about 1,000 degrees Cent. or 1,830 degrees Fahr. at which the shape can be transformed without effecting the texture, then the lower limit at about 500 degrees Cent., or a little over 900 Fahr., and work done between these limits determines the final texture.

One point that I have omitted to touch upon is that under the old process when blooms had to be re-heated these same blooms were generally chipped of all slivers before being re-heated.

Under the present process nothing of the kind is done, and as a result these slivers, when the finished rail is produced, often appear in the shape of a surface defect, and sometimes pass by unnoticed, resulting later on in the rapid wear and sometimes in the absolute destruction of the rail itself.

Frequently it has been said that the large increase in traffic and the increase of equipment are the true causes of the poor showing of the rails manufactured to-day, and even maintenance of way men have said the same thing, not being familiar evidently with the manufacture of the rail, and in contradiction to this statement, old rails of former manufacture have been laid alongside of new rails, showing conclusively that the old rails stand up better than the new.

It might be stated, however, that on investigations recently made on rails that have broken during wrecks, that the failure was attributed to fracture, and that the poor service of the rail was due to one of the following causes: First, pipes in the steel; second, excessive segregation; 3rd, rough handling, resulting in fracture.

These several points should be carefully checked at the point of manufacture by a representative of the railway company, who should be on hand at the time the material is being rolled at the mills.

First, the item of piping in the steel can be avoided to a great extent by seeing that a sufficient amount of steel is cropped from the ingot; also seeing that the blooms on being sheared show no indications of being piped.

Secondly, in regard to excessive segregation, this is possibly a little more difficult to detect, and is best detected by a series of drop tests.

In the matter of rough handling, the initial fracture may occur at the mill during the process of straightening or even while being loaded into a high-side car and allowed to drop from a height of seven or eight feet into the cars on top of other rails. So that it should be the representative's duty to be most careful in his supervision during the different processes of manufacure, and also the handling in loading and unloading. These several points are generally noted in almost every specification. Touching on the increased heavy rail section of 90 to 100 pounds, instead of the previous lighter section rails which have been formerly used under lighter traffic, it is a known fact that in the formation the head principally is the increased mass, and that the other parts of the rail have increased but little in thickness, as a result of these changes the flange gets to the lowest temperature at which it can be rolled long before the head reaches the same temperature, and consequently causes unevenness in texture, resulting in the rapid wear of the rail. The matter is now under discussion to re-arrange the proportions of the rail—that each part shall reach the critical temperature at more nearly the same time. I noticed recently in one of the largest American rail mills in particular, that it is common practise to leave four rails on the table at one time before entering the finishing pass, and from timeing this operation I discovered that each one of these rails was being held fully three minutes before being put through the finishing pass, the object being to give greater toughness and better wearing qualities, owing to finishing at a low temperature. Unfortunately the plan is of little benefit, as the penetration of the fine granular structure is only about an eighth of an inch, and becomes quickly worn away in service. Another scheme also in vogue at present in a large mill is the concentration of a water jet over and under the head of the rail prior to being finished in the last pass of the mill. This process is to bring the head of the rail to as near the same temperature as possible as the web and flanges, thus adding toughness, and as the manufacturers claim forming a more homogeneous structure.

Another point that must not be overlooked is the frequent complaints that we hear concerning depressed joints, and the blame is attached to the process of manufacture, which is not altogether at fault, as this results rather from roadbeds being improperly ballasted, allowing an undulation of the rail under traffic and especially at the rail joints, where the ends of the rails constantly work up and down against the treads of the wheels, and thus batter down.

In conclusion I might state that I think in Canada to-day we are getting as good a quality of rails as manufactured anywhere. On the one hand the rail, as furnished by the open-hearth process at the works of the Dominion Iron and Steel Company, is suited to the heavier section of rail, more especially on account of their being able to eliminate the phosphorus and sulphur elements, which cause much brittleness when combined with high carbon. On the other hand, the rail as being furnished by the Bessemer process at Sault Ste. Marie is suited to the lighter sections on account of the moderate capacity of the Bessemer converters; also the moderate output of the mill.

## CORRESPONDENTS FOR THE "ENGINEER."

**Correspondents for the weekly edition of the "Canadian Engineer" are wanted in every town in Canada. Descriptions and illustrations of notable construction works specially welcome. Copy should reach the Toronto office by Tuesday morning. Papers mailed to subscribers Thursday evenings.**

## ASPHALT WORK IN ST. JOHN, NEW BRUNSWICK, YEARS 1902, 1903, 1904, 1905, and 1906.

**By R. H. Cushing.***

Municipal engineers and contractors generally will find the information given in this report exceedingly valuable, since it will enable them to compare the cost of the work they are doing with what is being done by Mr. Cushing in St. John, New Brunswick. Reports of this kind are valuable for purposes of comparison, and they will always be gladly received.

The engineers of Canada are invited to use "The Canadian Engineer" as a means of intercommunication on all subjects of interest to engineers generally. Your co-operation in this matter will help us to help you, and others, and it is the hope of the proprietors that every engineer, and those in touch with engineering projects, make use of the "Engineer" from time to time.

**Sidewalks and Crossings only.**

Season is from May 1st to November 20th.

Laid from 36,000 to 43,000 square yards per season.

Laid 203,600 square yards in the five years, of which one-twentieth was new work, and nineteen-twentieths repairs.

All the work of mixing, spreading, rolling, etc., was done by hand.

A crew consists of one foreman, one pot man, three men, and one horse and sloven; costing in all, $10.40 per day, and they average 128 square yards of completed work each day of nine hours.

Weather conditions admit of working 90 per cent. of full time. Boiling pot, sand heaters, mixing platform, etc., are moved from place to place, so haul from place of mixing to place of laying does not exceed one-half mile, and the time of mixing and setting up said plant is included in cost; a crew puts out five mixes per day, averaging about 25 square yards per mix.

**Cost.**

| | | |
|---|---|---|
| 203,600 square yards, labor ........... | $16,028 00 | |
| Material and tools ...................... | 28,682 00 | |
| Total ................................ | | $44,710 00 |
| Cost per square yard, labor ........... | 08 | |
| Material and tools ...................... | 14 | |
| Total ................................ | | 22 |

Lumber, tools, maintenance and removals of plant are included in the above figures, and amount to about $90 per year.

No allowance is made for interest on cost of plant, since this is very small; nor is any allowance made for depreciation of plant, as the cost of maintenance and renewals is included in the above, and the plant is in better condition now than it was in 1902.

No allowance is made for superintendence or office staff, as this work is performed by the regular city officials without extra cost.

**Material.**

In laying the 203,600 square yards the following material was used.

All material delivered at mixing place:—

| | |
|---|---|
| Dry hard-wood, 305 cords, at $6 ................ | $1,830 00 |
| Tar, 42 gallons per barrel, 3,580 barrels, at $2.55.. | 9,129 00 |
| Refined Trinidad Lake Asphalt, 2,224 barrels, $4.65. | 10,341 60 |
| Sand, 10 barrels per 2-horse load, 5,610 loads, $1.25. | 7,012 50 |
| Gravel hauled from beach and included in labor. | |
| Total ........................................ | $28,313 10 |

Material required for 1,000 square yards of such asphalt work:—

| | |
|---|---|
| Dry hard-wood, ................................ | 1.50 cords. |
| Tar, 42 gallons per barrel ..................... | 17.60 barrels. |
| Trinidad Lake Asphalt, (refined) ............. | 10.92 " |
| Sand, 10 barrels per load ...................... | 27.56 loads. |

*Director Public Works Department, St. John, N.B.

# CHART OF ANALYSES OF MINERALS OF COMMERCIAL IMPORTANCE.

## PART I.

| Metal | Principal Ores | Composition Approximate Per Cent. | Hardness | Spec. Grav. | Color | Uses |
|---|---|---|---|---|---|---|
| Aluminum.... 35c. pound | *Corundum...... | Aluminum 53; oxygen 47... | 9 .. | 4 .. | Various.......... | Emery, abrasive materials. |
| | *Bauxite....... | Alumina 74; water 26...... | | 2.5.. | White gray, yellow and red... | Aluminum metal source. |
| | Alunite (alum stone)......... | Alumina 37; sulphur trioxide 38; potash 11; water 13.................... | 4 .. | 2.5.. | White, gray and reddish........ | Fire proof covering, preserving wood, paper manufacture, etc. |
| Antimony..... 14c. pound | *Stibnite... .... | Antimony 71; sulphur 29... | 2 .. | 4.5.. | Lead gray....... | Alloy in type metal, britannia, pewter. |
| | Stibiconite...... | Antimony 74; oxygen and water 26............... | 4 .. | 5.2.. | Pale yellow... .. | |
| Arsenic....... White 3c. Red 6c. | *Arsenopyrite.... | Arsenic 46; sulphur 19; iron 34..................... | 5 .. | 6 .. | Silver white. ... | Tanning, manufacturing paris green, etc, vermicides, medicines |
| | Orpiment....... | Arsenic 61; sulphur 39...... | 1.5.. | 3.4.. | Yellow.......... | |
| | Arsenolite...... | Arsenic 75; oxygen 24...... | 1.5.. | 3.7.. | White.......... | |
| | Realgar......... | Arsenic 70; sulphur 30...... | 1.5.. | 3.5.. | Red orange...... | |
| Barium....... $28 ton | *Barite.......... | Baryta 66; sulphur tri-oxide 34.................... | 3.3.. | 4.5.. | White, yellow and various........ | Pigment, mixed with white lead, zinc white, increasing body and life of the paint. |
| | *Witherite....... | Baryta 77; carbon di-oxide 23..................... | 3.5.. | 4.3.. | White, gray, etc . | |
| Beryllium..... | Emerald........ | Silica and alumina 84; beryllium oxide 12; chromium iron etc. 4................ | 8 .. | 2.7.. | Rich green...... | Precious stones. |
| | *Beryl.......... | Silica and alumina 83; beryllium oxide 15; iron and lime 2.................. | 7.5.. | 2.7.. | Bluish green. . . | |
| Bismuth....... $2.10 pound | Tetradymite.... | Bismuth 51; tellurium 20; sulphur 28.............. | 1.5.. | 7.5.. | Tin white....... | Forming alloys with certain metals where low melting point is essential. Medicines. |
| | Bismutite...... | Bismuth oxide 88; carbonic oxide 12............. | 4 .. | 7 .. | White green and yellow......... | |
| | Bismuthinite.... | Bismuth 81; sulphur, etc. 19 | 2 .. | 6.5.. | Lead gray....... | |
| | Bismite......... | Bismuth 96; oxygen 4...... | .... | .... | Gray, green yellow and white | |
| Boron......... 25c. pound | *Borax.......... | Boron tri-oxide 36; soda 16 water 47................ | 2.2.. | 1.7.. | White.......... | Metallurgy, flux, soldering and brazing, granite ware enamelling, soaps, glass preserving foods, medicine, etc. |
| | *Colemanite..... | Boron 25; calcium 12; oxygen and water 56......... | 4.5.. | 2.4.. | White.......... | |
| | Boracite........ | Boron tri-oxide 62; magnesia 31; chlorine 7......... | 7 .. | 3.0.. | White yellow, and green.......... | |
| Cadmium...... 14c. pound | Greenockite..... Associated with many zinc ores | Cadmium 79; sulphur 21...... | 3 .. | 5 .. | Light yellow..... | Alloys with low melting point pigment |
| Calcium....... | *Calcite......... | Lime 56; carbon di-oxide 44 | 3 .. | 2 .. | White pearly..... | Flux, etc. |
| | *Gypsum......... | Lime 32; sulphur tri-oxide 37 water 30............... | 2 .. | 2.3.. | White pearly..... | Plaster paris, chalk, etc. Various. |
| Carbon........ | Diamond........ | Pure carbon 100........... | 10 .. | 3.5.. | White straw..... | Precious stone. |
| | *Graphite....... | Carbon 90 to 98............ | 1.5.. | 2.2.. | Iron black...... | Crucibles, lubricants, etc. |
| Cerium........ Yttrium........ Lanthanum.... Didymium...... Thorium...... | Yttrocerite...... | ........ Fluorine 25; lime 47; cerium protoxide 18; ytiria 10....... | 4 .. | 3.5.. | Violet and reddish brown.......... | In the manufacture of the Nerst electric lamp. |
| | Monazite....... | Cerium, lanthanum and didymium phosphates, with from 3 to 9% thoria....... | 5 .. | 5.2.. | Yellowish to reddish brown..... | |
| Chromium..... 80c. pound | *Chromite....... | Chromium sesqui-oxide 68; iron protoxide 32......... | 5 .. | 4.5.. | Black to brownish | Chrome steel and various alloys with iron. |
| | *Crocoite....... | Chromium tri-oxide 31; lead oxide 69.............. | 2.5.. | 6 .. | Red............ | |
| Cobalt........ 60c. pound | Smaltite........ | Cobalt....; nickel-arsenic... | 5.5.. | 6.5.. | Tin white....... | |
| | *Cobaltite....... | Cobalt 35; sulphur and arsenic 65............... | 5.5.. | 6 .. | White reddish... | |
| | *Asbolite........ | Cobalt-oxygen......; manganese............ | | | Bluish black..... | |
| Copper....... 17½c. pound | *Chalcocite...... | Copper 80; sulphur 20...... | 2.5.. | 5.7.. | Steel gray........ | Electric appliances, alloys, brass, bronze etc. |
| | *Bornite......... | Copper 56; iron 17; sulphur 27.................. | 3 .. | 5 .. | Brownish bronze. | |
| | *Chalcopyrite.... | Copper 35; iron 30; sulphur 35.................. | 3.5.. | 4.2.. | Brass yellow..... | |
| | Tetrahedrite.... | Copper 37; iron 2; zinc 2; antimony 26; sulphur 26; silver etc.............. | 3.5.. | 5 .. | Gray............ | |
| | Cuprite......... | Copper 88; oxygen 12........ | 3.5.. | 6 .. | Deep red......... | |
| | Malachite. ..... | Copper oxide 72; water 9; carbonic acid 19.......... | 5 .. | 5.2.. | Bright green..... | |
| | Azurite......... | Copper oxide 69; water 6; carbonic acid 25.......... | 3.5.. | 3.7.. | Azure blue...... | |
| | Atacamite...... | Copper chloride, oxygen-water........ | 3 .. | 3.7.. | Deep green...... | |
| Fluorine....... | Fluorite........ | Calcium fluorine........... | 4 .. | 3 .. | Violet, pink, etc.. | In glass manufacturing, flux. |
| | Cryolite........ | Sodium, aluminum, fluorine.. | 2.5.. | 3 .. | White brownish.. | |
| Gold......... $20.67 oz. | Native......... | In placers, associated with various ores, both oxides and sulphides............ | 2.5.. | 19 .. | Yellow.......... | Coinage, jewelery, dentistry, etc. |
| | Calaverite...... | Gold 44; tellurium 56....... | 2.5.. | 9.3.. | Bronze yellow... | |
| | *Sylvanite....... | Gold 29; silver 15; tellurium 56.................. | 1.5.. | 8 .. | Silver white..... | |
| | Petzite.......... | Gold, silver and tellurium... | 2.5.. | 9 .. | Iron gray....... | |
| Iron.......... | *Hematite....... | Iron 70; oxygen 30.......... | 6 .. | 5 .. | Powder red...... | |
| | *Magnetite...... | Iron 72; oxygen 28......... | 6 .. | 5 .. | Iron black...... | |
| | *Pyrrhotite...... | Iron 60; sulphur 40......... | 4 .. | 4.5.. | Dark bronze..... | |
| | *Pyrite.......... | Iron 46; sulphur 54......... | 6 .. | 5... | Brass yellow..... | |
| Lead.......... $5.60 100 lbs. | *Galena......... | Lead 86; sulphur 14......... | 2.5.. | 7.5.. | Lead gray....... | |
| | Nagyagite...... | Lead 54; tellurium 32; gold 9; silver, etc.............. | 1.5.. | 7 .. | Blackish gray.... | |
| | Minium......... | Lead 90; oxygen 10........ | 2.5.. | 4.6.. | Red............ | |
| | Anglesite....... | Lead oxide 73; sulphur 27... | 3 .. | 6 .. | White.......... | |
| | Pyromorphite... | Lead oxide 82; chlorine 2; phosphorous pent ox. 16. | 4 .. | 7 .. | Green brown, gray and white | |
| | *Cerussite....... | Lead oxide 84; carbon dioxide 16.............. | 3 | 6.4.. | White.......... | |

# THE CANADIAN MINING INSTITUTE.

## NINTH ANNUAL MEETING HELD IN TORONTO, MARCH 6th, 7th and 8th.

The mining engineers and many others interested in the mining industry were gathered together in Toronto recently, the occasion being the ninth annual meeting of the Canadian Mining Institute. A number of prominent persons interested in mining in the United States were also among those present, some of whom are interested in Canadian mining properties, and, therefore, took a special interest in the proceedings of the Institute.

### THE OPENING SESSION.

About one hundred delegates were present on Wednesday morning, when the meeting was called to order in the banquet hall of the King Edward Hotel, the headquarters of the convention. President Geo. R. Smith, of Thetford Mines, Quebec, was in the chair, and opened the meeting with the presidential address. Since the meeting was held in the Queen City, the capital of Ontario, President Smith's address was admirably adapted to the occasion, reviewing as it did the mining industry of this Province.

**President's Address.**

Gentlemen,—Just a year ago, in opening the eighth annual meeting of the Canadian Mining Institute I was afforded the exceptional pleasure of welcoming you to the cradle of the Canadian nationality, that ancient capital of an old French Province, so justly renowned for its wealth of historical association and peculiarly beautiful surroundings. To-day, it is my privilege to greet you in the magnificent Queen City of the great and wealthy sister Province of Ontario.

Last year we peered together through the mists of vanished years to the early days in the history of New France, when the first development of mineral wealth in North America by European settlers was aided by the fostering care of the great French Minister, Colbert. To-day we meet in a Province possessing the youngest Bureau of Mines of any of the older Provinces of Confederation, and in which State encouragement and recognition of the mining industry can scarcely be traced back more than fifteen years, as compared with the two and a half centuries which have elapsed since the French Minister of State lent his powerful patronage to the first practical mining essays in New France. It is said, nevertheless, that as early as 1660 Jesuit missionaries reported gold having been found on St Joseph Island, in Lake Huron, and Mr. Merritt tells us that copper ore was actually worked in this Province, in the vicinity of Pointe aux Mines, or Mica Bay, as early as 1770, an English company having sank some thirty feet on a vein, which decreased in size and was abandoned. I am not going to detain you by recalling any of the details of the early operation of the Bruce Mines, to the north of the St. Mary River, or of the circumstances which attended the production, in 1800, in Leeds county, of iron manufactured from ore exploited in the vicinity.

While for a great number of years the mining development of this great Province was extremely intermittent, chiefly owing to the fact that no smelting was carried on here, and that the demand for ore came chiefly from the other side of the international boundary line, yet in recent years the advance in the mining operations of Ontario has been little short of marvellous. The metallic productions alone of Ontario increased from $2,565,286 in 1900 to $5,321,677 in 1904. From 1904 to 1907 there will undoubtedly be a still greater increase. The output of silver, cobalt, iron ore, pig iron and steel was given as nil in the report of the Bureau of Mines for 1895, and in 1904 the output of silver was placed at $111,887; of cobalt, $36,620; iron ore, $108,068; pig iron, $1,811,664, and of steel, $1,188,349. The report of your Minister of Mines for 1905 claims that the Sudbury nickel-copper deposits constitute the chief source of the world's supply of nickel. The output of nickel for that year was given as $3,344,409, while the copper contents of the matte amounted to $671,833; and if these deposits had been computed at the price of the refined metals, as is done in many public statistics, their total value would have been but little short of ten millions, while employment was furnished by them to over a thousand men.

And to all these facts and figures illustrative of the rapid development of your mining industries in recent years there is yet to be added the marvellous story of Cobalt and its apparently almost inexhaustible stores of untold wealth, which has already proved itself to be a second Klondike in the world-wide interest which it has aroused.

Your Province is also to be congratulated upon possessing, in the person of your active Minister of Mines, the Hon. Mr. Cochrane, one who has not only taken the keenest interest in the industry, but has also borne in mind, in his recent legislation, the protection that is due to individual rights.

I would not, however, lead you to believe that you hold all the silver and other good things in the country. We, in Quebec, upon your eastern boundary, have a great undeveloped mining territory, within ten or twelve miles of you, in the Temiskamingue country. You are more fortunate in your Cobalt district than we are in our far north because of the railway development, which gives you direct transportation facilities to the very mouth of your most valuable mines. Yet it is only a question of time when we, too, shall have railway communication with the great northern mineral belt of our Province, a communication which I hope will prove useful to both Provinces. Last year, as you will remember, I remarked upon the opening up of undeveloped mineral resources, which I felt sure would follow the construction of the Transcontinental Railway. I am more than ever impressed with the assurance of this fact.

We, in Quebec, are only most anxious to join with you in Ontario, without regard to any political considerations, in assuring the best possible legislation for the interests of the mining industry in general, as well as for those engaged in it.

It is sincerely to be hoped that the time is not far distant when we shall have Canadian smelters for treating Canadian ores at home instead of having to ship these latter to the United States for treatment.

The Institute has already proved its efficiency and its ability to largely assist the miner in perfecting his work and carrying out his ideas. It is only by concerted action and by the maintenance of an association of this kind that the miner can feel that from Sydney to the Yukon his interests are thoroughly protected, and this unity of purpose and action is bound to secure for mining men that reasonable legislation which is necessary to the successful carrying out of their work. The annual increase in membership shows the popularity of the institution.

The modern idea among all professional and scientific classes, civil and mechanical engineers, as well as miners, of becoming incorporated for mutual benefit and support can only result in good.

There may be a feeling on the part of some among us that our by-laws or the method or result of our elections are not in accord with the ideas of all our members; but our constitution and by-laws themselves provide any remedy that may be desired in this respect, and after due notice they may be readily amended. Neither any particular Province, nor yet any set of men in the Dominion should, however, in my opinion, ask for special provisions to meet special conditions.

It is well that outsiders should know, as well as we do, that the Institute is not for the benefit of speculators or mining manipulators, but was established and is maintained for the advancement and protection of genuine mining interests all over the country. To render its work effective and its influence paramount it is first of all essential, of course, that it should have our loyal adhesion and support. Then, while our individual operations, and even the industry as a whole, may have their respective ups and downs, the Institute, like Tennyson's brook, will flow on forever. And, though Cobalt, contrary to every indication, should see its failure, as Port Arthur did some twenty years ago, the Mining Institute would continue its career of usefulness for future generations.

It is scarcely possible for me to declare the present meeting open in this hotel without a passing reference to the unfortunate circumstances attending our former meeting here. There can be no doubt whatever that the regretted death of our then late esteemed secretary, Mr. B. T. A. Bell, upon the very eve of the meeting, cast a damper upon the entire proceedings of the convocation of that year, so that it was scarcely possible for the city of Toronto or the Province of which it is the splendid capital to have formed from that meeting any fair idea of the importance and the influence of the Institute.

We meet again to-day in Toronto, not only as in one of the mining centres of the Dominion, but as the centre of the Dominion from the mining standpoint.

In declaring this ninth annual meeting of the Canadian Mining Institute open for the despatch of business it is in no purely formal manner that I express the fervent hope that you will each and all unite in contributing to its interest and success.

The papers that are to be read cannot but prove instructive to every mining man, covering as they do everything in our industry from coal to gold.

It only remains for me to thank you for having honored me with the highest office in your gift, and to ask for your continued confidence and support during the sessions of the present convention.

**Secretary's Report.**

The report of secretary, H. Mortimer-Lamb, showed the Institute to be in a very healthy condition, the membership having increased by 25 per cent. during the past year, quite a number of students having been admitted. This report was unanimously accepted.

**Treasurer's Report.**

Even more interesting than the report of the secretary was that of treasurer, J. Stevenson Brown, the results of which were very gratifying. The total receipts for the year, including a balance of $1,191.84, which was carried forward, were $8,006.03, with total disbursements of $6,651.83, leaving a balance on hand of $1,354.20, with no outstanding accounts. A particularly interesting part of the report was a statement of the balances on hand each year, beginning with 1900:—

| | | | |
|---|---|---|---|
| Balance | for | 1900 | $ 484 00 |
| " | " | 1901 | 636 00 |
| " | " | 1902 | 957 00 |
| " | " | 1903 | 1,682 00 |
| " | " | 1904 | 1,909 00 |
| " | " | 1905 | 658 00 |
| " | " | 1906 | 1,191 00 |
| " | " | 1907 | 1,354 00 |

This report was also unanimously accepted.

**Papers.**

The routine business of the meeting being concluded, the reading of papers was gone on with. These papers took up the greater part of the three days' session, and, as there were no less than fifty on the programme, it is impossible to give here anything more than the titles of same, together with their authors, although it is quite possible that some of them will be reproduced from time to time. A list of the papers follows:—

Presidential address, by Geo. R. Smith, M.L.A., Thetford Mines, Que.; The Iron Ores of Canada, by Prof. C. K. Leith, Madison University, Wisconsin; Magnetic Separation by the Grondal Process, by F. A. J. Fitzgerald and P. McN. Bennie, Niagara Falls, N.Y.; The Iron Ore Deposits of Temagami District, Ont., by Alfred E. Barlow, D.Sc., Ottawa; The Supplies and Reserves of Iron Ores, by John Birkinbine, M.E., Philadelphia, Pa.; The Geology of the Cobalt District, by President C. R. Van Hise, Madison University, Wisconsin; The Smelting of Cobalt Ores, by Hiram W. Hixon, Victoria Mines, Ont.; The Cobalt Ores Deposits, by M. T. Culbert, Cobalt, Ont.; The Cobalt Mining District, by Dr. Robert Bell, Ottawa; Notes on Some Additions to the Map of Cobalt, by W. G. Miller, Provincial Geologist, Toronto; New Discoveries in Northern Quebec, by J. Obalski, Superintendent of Mines, Quebec; Microscopic Examination of Nickeliferous Pyrrohotite, by Dr. Wm. Campbell, Columbia University, New York; The New Tilbury Oil Fields, Ont., by Eugene Coste, E.M., Toronto; The Minerals of Alberta, by D. B. Dowling, Ottawa; Further Observations on the Copper Deposits of British Columbia, the Yukon and Alaskan Coast, by W. M. Brewer, Victoria, B.C.; The Marble Bay Copper Deposit, Texada Island, B.C., by O. E. Leroy, Ottawa; The Geology of the Franklin District Ore Deposits, B.C., by R. W. Brock, Kingston, Ont.; The Emma Mine, Boundary District, by Frederic Keefer, Greenwood, B.C.; Progress of British Columbia's Mineral Production, 1897-1906, by E. Jacobs, Victoria, B.C.; Some Notes on the Economic Geology of the Skeena River, by W. W. Leach, Ottawa; Notes on Recent Developments in Quartz

**President Frederick Keffer.**

Mining in the Yukon, by D. D. Cairns, Ottawa; Recent Mining Conditions in the Yukon, by R. G. McConnell, Ottawa; Canadian Graphite, by H. H. Brumell, Buckingham, Que.; The Carbon Minerals of New Brunswick, by Dr. R. W. Ells, Ottawa; The Undeveloped Coal Areas of Nova Scotia, by Dr. J. E. Woodman, Halifax, N.S.; The Mineral Resources of the Province of Quebec, by Fritz Cirkel, Montreal; The Undeveloped Mineral Resources of the Dominion, by Dr. Frank D. Adams, Montreal; The History of the Bruce Mines, Ont., by H. J. Carnegie Williams, Bruce Mines, Ont.; The Ownership of Mineral Deposits, by Frederick Hobart, New York; On Mining Royalties, by J. M. Clark, K.C., Toronto; Some New Points in the Geology of Copper Ores, by Prof. J. F. Kemp, Columbia University, New York; Magmatic Waters, by Hiram W. Hixon, Victoria Mines, Ont.; The Use of Graphic Formulæ in Metallurgical Calculations, by D. H. Brown, Copper Cliff, Ont.; On the Copper Deposits at Jevington, Nevada, by E. P. Jennings, Salt Lake City, Utah; The Status of Mining in Canada, by J. C. Gwillim, Kingston, Ont.; Reflections on Mines and Mining in Canada, by N. Daru, Geological Survey of India; The Origin of Deposits of Pyrites, by A. P. Willmott, Sault Ste. Marie, Ont.; Recent Discoveries of Iron in the Torbrook District, by W. F. C. Parsons, Londonderry, N.S.; Fifty Years of Mining and Metallurgy in Eastern Canada, by Major R. G. Leckie, Sudbury, Ont.; Sir William Logan and Our Geological Survey, by Dr. Robt. Bell, Ottawa; Diamond Mining in South Africa, by Dr. J. Bonsall Porter, Montreal; Anthracite Mining Methods in Pennsylvania, by

H. H. Stock, Editor "Mines and Minerals," Scranton, Pa.; On Electric Furnaces, by Dr. A. E. Stansfield, Montreal.

**Student Papers.**

The Cariboo Consolidated Hydraulic Mining Plant at Bullion, B.C., by W. T. Dick, McGill University, Montreal; the Oldham Sterling Gold Mines at Oldham, N.S., by C. V. Brennan, McGill University, Montreal; the Uses of Chemical Analysis on New Blast Furnace Practice, with Some Notes on Laboratory Methods, by G. D. Drummond, McGill University, Montreal; Basic Open-hearth Steel Manufacture at Sydney, C.B., by Frank E. Latho, McGill University, Montreal; Systematic Plan Tiling, by C. W. Murray, School of Mining, Kingston; Underground Practice at the Quincy Mine, Michigan, by G. R. McLaren, School of Mining, Kingston; Asbestos Mining in Quebec, by W. J. Woolsey, School of Mining, Kingston.

As will be seen from the foregoing list a number of "student papers" were to be presented, but owing to a lack of time the reading of these was omitted from the programme, and they are to be examined by appointed judges, who will determine as to the best paper, so that the medal awarded by the Institute may be given to the student preparing the best paper.

**By-laws.**

The remaining portion of the morning session was taken up with the making of amendments to the by-laws of the society, as follows:—

"Corresponding members shall be eminent technical or scientific persons, not resident in Canada, who, from their position and experience in pursuits connected with the mining and metallurgical professions, are enabled to promote the purposes of this Institute as set out in the charter thereof."

"Any member may be suspended from the list of members for cause on the recommendation of five members of council by a two-thirds vote by letter ballot of the whole council. This suspension shall be final, unless the member so suspended shall successfully appeal from the ruling at the next annual meeting of the Institute."

"Members in arrears for two years shall be considered as not in good standing, and shall not be entitled to vote, and their names may be removed from the list of members by the council at any regular meeting."

"The councillors of the Institute shall be sixteen in number, eight of whom shall be elected annually for a term of two years, and shall be eligible for immediate re-election."

"The council shall hold office as provided above. In case an officer, whose term has not expired, becomes a candidate for a higher office at the annual election, and be elected, his election to such higher office shall automatically create a vacancy in the office formerly held by such member. The members in session at the annual meeting may then proceed to elect a successor in the office thus created, and in the event of their failure to do so, the council shall make the appointment."

"The secretary shall keep a true and correct record of all the proceedings of the Institute, the council and all committees, and also a correct list of the members and student members of the Institute and their addresses. He shall conduct the correspondence of the Institute and issue all notices of meetings, as set forth in the by-laws. The secretary shall have the custody of the seal of the Institute. If in case of sickness, absence, or from any cause whatever, the secretary does not act for a period of one month, the council may appoint a secretary pro tem. The council shall remunerate the secretary at its discretion."

"For the election of officers the ballot shall be so designed as to provide for the signature of the voter on a coupon, which shall be detached before opening the ballots. The ballot should be enclosed in an envelope addressed to the secretary."

"The annual meeting shall appoint three scrutineers, who shall not be candidates for office. The scrutineers shall check names on the sealed ballots with the treasurer's list of members in good standing, and shall only accept the votes of members in good standing. All signatures of members voting shall be detached from the ballot slips before any of the ballots are opened. The scrutineers shall then open and count the ballots, and the candidates receiving the highest number of votes shall be elected. In case of a tie the scrutineers shall decide."

"Special meetings of the council may be called at headquarters at the written requisition of the president, or of at least five members of the council."

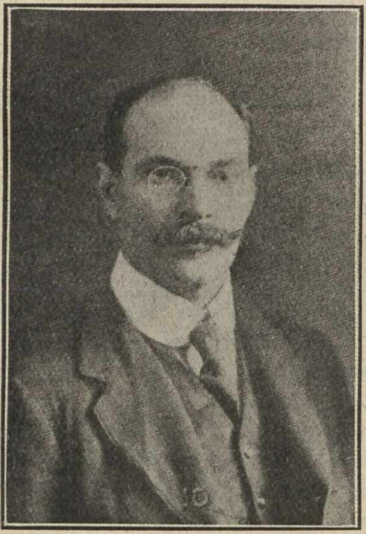
"In the event of it being advisable, in the opinion of the council, to hold special meetings elsewhere than at headquarters, this may be done by a vote in person or by letter ballot of a majority of the council. Two weeks' notice of such meeting must be given to all members of the council."

"So far as possible, papers and discussions shall be published first in pamphlet form, "Subject to revision," and distributed promptly to members."

"Premiums and prizes, at the discretion of the council, may be given annually for papers read by the students during the year. Any such award shall be made by the council within three months after the annual meeting."

"Each member not in arrears shall be entitled to a bound copy of the Journal of the Institute for the year of which he has paid his subscription. Each student member not in arrears shall be entitled to an unbound copy of the said Journal, or to a bound copy thereof by the additional payment of one dollar in advance."

The most important subject before the meeting was



Secretary H. Mortimer-Lamb.

the new mining taxation bill, now before the Ontario Legislature. On Wednesday afternoon Mr. J. M. Clark, K.C., of Toronto, read a paper on "Mining Royalties."

**"On Mining Royalties."**

It might safely have been predicted months ago that the increased interest in the mining industry of Ontario would result in an agitation for royalties or taxation. All that was required was to apply the maxim that history repeats itself. The elder generation will recollect that many years ago there was considerable interest in the Hastings district. This resulted in a statute, 27 and 28, Victoria Cap. 9m, Section 34, which provided for the payment to the crown of certain royalty on gold as there specified. The inevitable result was a very decided check to the growth of the industry. So much so, that in the first Parliament after Confederation the matter was taken up in the Ontario Legislature and all the royalties, taxes and duties before referred to were repealed and abandoned and a Statutory Declaration introduced that "such lands, ores and minerals shall henceforth be free and exempt from every such royalty, tax or duty." After a number of years with this Legislation on the Statute Book, some interest was gradually awakened in the mineral resources of the Province, with the result that another agitation for the imposition of royalties arose and certain royalties were imposed by the Statute of 1891, but confined to the lands located, sold and granted or leased by the Crown on or after the 14th day of May, 1891. The result of this legislation, though its application was limited, was to make it practically impossible to interest foreign capital in exploration and these royalties were in consequence subsequently repealed. The declaration above referred to, namely that such lands, ores and minerals shall be free and exempt from every such royalty, tax or duty, was substantially continued in our Statutes, and appears in the Revised Statutes of Ontario, 1897m, Cap. 36. The question of taxation is of course a vexed one, but it can be laid down as a general principle that the utmost good faith should be shown towards investors. The fact that the characteristic ores of the Province are of low grade and requiring as a general rule large amounts of capital for their development and working, would call for grave consideration of the whole problem. The great need of Northern Ontario is capital which cannot be secured unless faith is kept with investors. The immense injury which will result to the business, manufacturing and agricultural interests if the tremendous inflow of capital into this country is seriously checked, is so obvious as to require no argument to emphasize it. Many explorers and prospectors have spent all their resources and a large part of their lives in searching for mineral deposits in Northern Ontario. If a blow at the mining industry is now struck by the Legislature the fruits of their labors will be unjustly snatched from them. It is needless to add that if prospecting and exploration are discouraged there is not much hope of developing a great mining industry, which would be a great factor in the prosperity of the Province. In short, it is a foolish thing to kill the goose that lays the golden egg.

The discussion which followed the reading of Mr. Clarke's paper showed that the opinion was unanimous that the proposed taxing of the mines in Ontario would have a damaging effect on mining and allied industries in this Province. Mr. F. W. White, the representative of a number of Pittsburg capitalists stated that these men would not invest another cent in Ontario Mining properties if this law went into effect. Mr. Trethewey was of opinion that the bill would be passed. He said he believed in paying a tax on mining lots, but not as a royalty on the output. This tax, he claimed, would keep persons from holding lands without working them, and in this way would give our own prospectors a greater opportunity than they had at present. About fifty of those in attendance at the meeting waited on the Honorable Frank Cochrane, Minister of Mines, at 5 o'clock on Wednesday afternoon. The object of the visit was to lay before him the objections of the Institute to the proposed tax. A number of brief speeches were made, stating these objections, by President Smith, Mr. Leonard, one of the owners of the Coniagas claim; Col. Hay, Mr. S. Clarke, and Mr. F. H. Hartman, of Montreal. All agreed in asking that the act be left over until next session. Col. Hay declared that just such legislation had led to the Boer War. Mr. Coste said that the industry would suffer more from over-capitalization and stock gambling than from the tax.

In reply, Hon. Mr. Cochrane said that the arguments were very much the same as those used by the Cobalt deputation. It had been said that his views on mining taxation had changed since 1900. They had, but the conditions of mining had also changed completely. In regard to the tax on iron, he could say that every cent of the tax would be remitted on iron smelted in this Province. The difficulty with the royalties imposed by the late Government had been class legislation, varying with district and industry. The present tax was to be the same all over the Province. The tax was no more a confiscation of the titles than was any other tax.

An appointment was made to meet Mr. Cochrane again on Friday.

## SECOND DAY.

Before the reading of papers was continued, arrangements were made for the meeting with Mr. Cochrane on Friday, and the following committee was appointed: G. R. Smith, Col. A. M. Hay, J. E. Hardman, R. W. Leonard, J. M. Clark, A. P. Willmott, and D. H. Brown. This committee went carefully into the question, and the following resolutions were drawn up, to be presented to the Minister:—

"While freely acknowledging and assenting to the right of the Government to impose such taxation as may be necessary or expedient for purposes of revenue, yet it is an axiom of justice that all such measures of taxation should be framed only after such consideration and discussion as may ensure a minimum of discomfort and of burden to the industry thus taxed. Therefore, be it resolved, That the mining industry has no objection to taxation imposed of necessity and equitably distributed and collected, and provided, further, that such taxation thus imposed shall not attack rights and titles already vested with the sanction of the Crown; that it does object to the principle of a royalty tax, because it is confiscatory in its nature. Properties have been taken up under legislative enactments abolishing royalties in Ontario. It is impossible of collection except by an intolerable system of inquisition, which is imposed on no other business interests in the Province. It will undoubtedly act, as did the bill of 1891, to prevent the investment of capital in Ontario.

"In consideration of these facts, we hereby request the appointment of a commission to consider the bill along the following lines, namely: The amount of revenue which your Government deems necessary to procure from the mines of the Province; a proper and equitable method of collecting such revenue; the effect of such a tax upon the mining industry, and upon those interests which depend thereon; the history and effect of similar legislation in the Dominion of Canada; the following methods of raising such revenue if necessary: A tax on acreage of mining land; a tax upon the capitalization of mining companies; an increased annual license fee from incorporated mining companies; a tax on dividends declared by mining companies."

Thursday afternoon was devoted exclusively to the reading of papers. In one of these on "Cobalt," Professor W. G. Miller, Provincial Geologist for Ontario, stated that Cobalt had already made eight or ten millionaires, and from twenty to thirty persons worth from $25,000 to $400,000.

In the evening the annual banquet was held.

Seated in the banqueting hall were the men who have forced the earth to yield up her riches for the good of mankind, and a pronounced optimism prevailed in regard to the future of this wide-reaching industry. The rapidly growing importance of this source of national wealth was shown by the statistics on the menu card, The particulars were:—Production, 1877, very small; 1887, $11,321,331; 1897, $28,465,023; 1905, $69,525,170; 1906 (estimated), $80,000,000; 1907 (probable), $100,000,000.

Retiring President Smith presided in the early part of the evening, and Col. Hay during the latter part. After the customary toast to "The King," "The Dominion and Provincial Parliaments" was proposed. It was responded to by the Lieutenant-Governor, Hon. Frank Cochrane, Minister of Mines, and Hon. W. J. Hanna, Provincial Secretary. His Honor Lieutenant-Governor Mortimer Clark sounded a warning against making investments in mining schemes of a wild-cat nature. He said that the mining engineer had a great responsibility at the present time. He must stand between the public and the promoter. There were many people putting their savings into much-boomed mining enterprises who could ill afford to lose those savings, and it was part of the duty of the mining engineers of Canada to prevent, so far as they could, the publication of unreliable reports and prospectuses.

Touching on the opposition to the taxation of mines, Hon. Mr. Cochrane said he could assure the Institute of one thing—that if the bill became law he would see that it was enforced with equity and with the least possible irritation.

Hon. Mr. Hanna dwelt on the greatness of the mineral interests of this Province.

"The Mining Industry" was proposed by Col. Hay and replied to by Prof. J. F. Kemp, of Columbia University, and Mr. J. E. Hardman, of Montreal.

Prof. Kemp thought that the political economists had failed to realize that mining was one of the greatest sources of wealth in the world. The rise of England was parallel to that of her mining industries, and, later, they found Germany advancing to the front by reason of her mines. The same was true of the United States, and Canada was now rapidly forging to the front. No factor promoted more quickly the settlement of men in wild and remote countries than the rumors of the existence of gold and other minerals. Thus it was in the Klondike and in British Columbia.

Mr. Hardman was informed that the approximate production of minerals in Ontario was valued at $27,000,000 for the last year. No doubt existed that the great northland possessed vaster possibilities than were realized by the greater number of the people of the Province. He questioned whether the members of the Legislature knew the value of it or they would not strive after the thimbleful of water when they might get the hogsheadful after a time. To tax the prospectors was like the highwayman taking the money from those who possessed it. The northern part of the Province would produce its greatest wealth from the more stable ores, found both to the north and height of land. Quebec had also enormous stores of this mineral wealth. Let them put the pack on the full-grown man and he could get safely to the other side of the portage. If they put it on the youth he would die. Thus it was with the infant mining industry.

Dr. Ledoux, of New York, Mr. R. W. Leonard, and Mr. Corbett, of Nova Scotia, responded to "Sister Societies."

**Treasurer J. Stevenson Brown.**

"Transportation" was spoken to by Mr. R. C. Steele, president of the Board of Trade.

## THIRD DAY.

On Friday morning the officers elected for the ensuing year were announced as follows:—

President—Frederick Keffer, Greenwood, B.C.

Vice-Presidents—Dr. J. Bonsall Porter, Montreal; W. G. Miller, Toronto; W. Fleet Robertson, Victoria, B.C.

Secretary—H. Mortimer-Lamb, Montreal.

Treasurer—J. Stevenson Brown, Montreal.

Executive Council—E. W. Gilman, Montreal; James McEvoy, Fernie, B.C.; R. W. Brock, Ottawa; J. C. Gwillim, Kingston; F. D. Adams, Montreal; H. E. T. Haultain, Craigmont, and David H. Browne, Copper Cliff.

The result of the ballot was received with applause, and followed by votes of thanks to the retiring officers.

Upon the announcement of the election of officers Retiring President Smith resigned the chair, which was taken by Mr. Keffer, the new president, and the reading of papers proceeded.

At noon the committee waited on Mr. Cochrane to discuss the resolutions adopted by the Institute on the previous day.

The result of this interview was that while the committee adhered firmly to the resolutions passed by the Institute, yet upon the personal assurance of the Minister that he would modify certain clauses to meet objections which were stated, and upon his statement that some such measure for revenue would have to be enacted at this session, and his further assurance that as Minister of Mines, he would see to it that the execution of the law should be made as little onerous as possible; that he would be willing to support a new bill drafted to meet the views of the mining men if the same could be made ready within one year, the committee decided to leave the matter in the hands of Mr. Cochrane for this year. They pledged themselves to submit to him within twelve months the draft of a new bill which would be more acceptable to the mining interests of Ontario. This action was taken in consequence of the personal confidence which the mining men have in Mr. Cochrane.

The remaining part of the day was devoted to the reading of papers. During the meeting arrangements were made for an excursion to Cobalt, and on Friday evening many of the members from outside points left Toronto to spend a couple of days in the New Ontario mining district.

The following is a partial list of those in attendance:—

Toronto.—I. Moffat, E. Coste, B. A. C. Craig, E. S. Francis, A. P. Coleman, D. M. Scott, W. G. Miller, D. B. Gillies, D. Grimray, J. H. Chemeth, J. J. Salmond "Canadian Engineer," R. E. Hore, G. R. Mickle, D. F. Kerr, J. M. Ousta, J. J. Currie, R. E. Kemerer, E. T. Carkill, J. B. Tyrrell, S. Dillon-Mills, Percy W. Ball "Canadian Engineer."

Montreal.—A. W. G. Wilson, Dr. J. B. Porter, J. S. Browne, S. J. Lloyd, A. Stansfield, F. Cirkel.

Ottawa.—W. H. Boyd, D. B. Dowling, R. Bell, Eugene Haanel, F. W. Stiles, J. McLeish, W. W. Leach, R. McConnell, D. D. Cairns, A. M. Campbell.

Quebec.—J. Obalski.

Thetford Mines, Que.—Geo. R. Smith.

Kingston.—R. W. Brock, O. W. Knight, W. J. Woolsey, J. C. Gwillim.

Cobalt.—F. C. Loring, C. W. Jessop, T. R. Gordon, A. A. Cole, H. V. Gardener.

Sudbury.—W. W. Steel, R. W. deMorest.

Rosseau.—G. Gellonleith.

Craigmont.—H. E. C. Haultain.

Buckingham, Que.—H. H. Brumell.

Haileybury.—A. H. Brown, A. Hay.

Madoc.—W. A. Hungerford.

Greenwood, B.C.—F. Keffer.

Sydenham.—G. W. McBaughton.

Victoria.—E. Jacobs.

Massey.—J. Errington.

New York.—F. Hobart, A. R. Ledoux.

Cleveland.—F. W. White.

Surat, India.—N. D. Daru.

Scranton, Pa.—H. H. Stock.

**Visit to Cobalt.**

A hearty welcome was extended to the visitors at Cobalt. They arrived at 10.45 a.m. on Saturday, and visited the Buffalo, Nipissing, Trethewey and Coniagas properties. Although the Nipissing shafts are closely guarded, they were opened to the visitors. On Saturday evening a public meeting was held at which the retiring president took the chair. Mr. Smith stated that the nucleus of the Mining Institute was a body of men brought together to oppose the mining tax in Quebec in 1891. He said that in twenty years this northern country could not have been opened up as much as it had been already by the Cobalt development, and that he was strongly against the Ontario mining tax about to be imposed.

Col. Hay referred to the mining industry of this Province as a "baby," and he believed the taxation of mines would kill it.

Mr. O'Connell, of the "Green-Mehan" Mine, said that he believed a good, clean profit from the camp would amaze the public, and that it could not be prospected in twenty years.

Mr. Loring, of the Trethewey, said that money had been easy to get, and in consequence no real mining had been done as yet.

Prof. Miller stated that on one forty-acre lot above the one hundred-foot level there were ten or fifteen million dollars worth of ore. The camp was unequalled in North

America in mineral structure. All it needed was development.

On Sunday the delegates visited the University, Foster, Jacobs, and Drummond mines, and all were assured of the stability of the Cobalt mining area. It was remarked that, although there had been much talk of "wild cats," the inspection of the mines led them to believe that the properties would be of permanent value.

The general opinion was that this, the ninth annual meeting of the Institute, was a great success, and everyone in attendance went home feeling that they had spent three very profitable and pleasant days in the Convention City of Canada.

## AN ELECTRICAL INDICATOR FOR WATER TANKS.

By C. H. Glasser.*

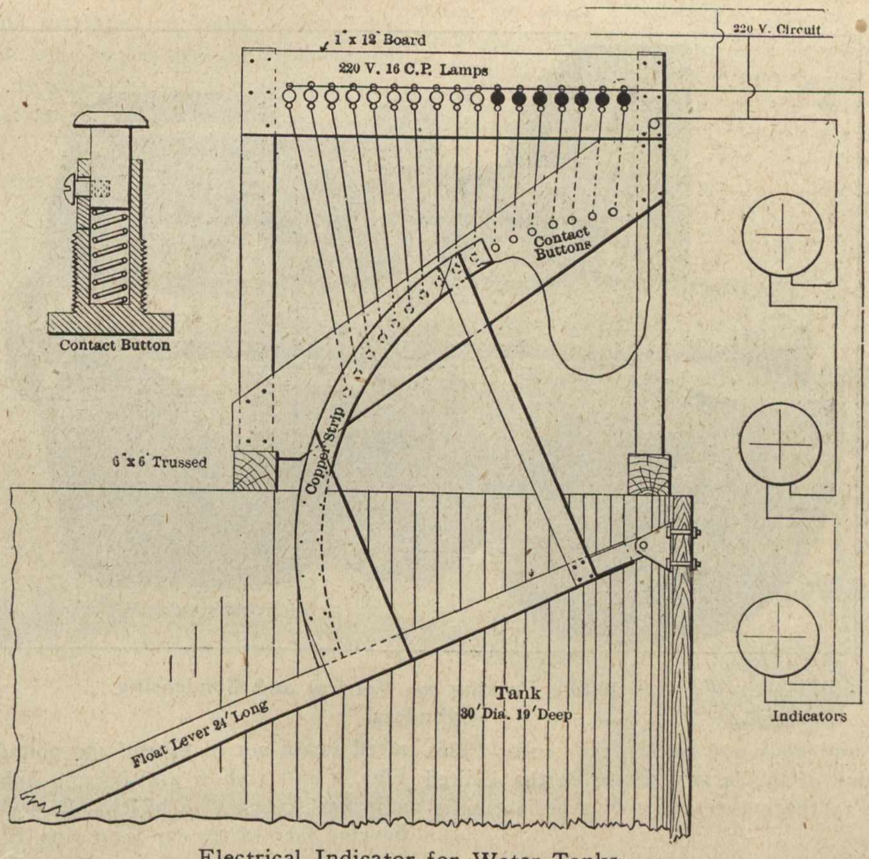
The water supply of the Tennessee Copper Company's smelting plant is delivered to the smelter-service tanks by a belt-driven centrifugal pump operating under head of 120 feet and located about two thousand feet from the smelting plant. It was not feasible to regulate the speed of the pump to the variable requirements of the smelter consumption, and it is important that the pump operator, chief engineer and furnace foreman is at all times correctly informed as to the depth of water in the service tanks. This is now accomplished by means of indicators placed at different points in the works, which give by direct readings the depth of water to the nearest even foot.

When such indicators were first contemplated considerable correspondence was concluded with different parties claiming to supply electrical equipment which would accurately give the required indications, but it was found that the apparatus proposed was of such complexity or required such multiplicity of wiring that they were not deemed feasible for the purpose. The depth of the tanks is 19 ft., and we required the apparatus to indicate the approximate height of water in the tanks at any desired number of stations throughout the works.

One correspondent stated positively that such indications could not be obtained without the use of 19 separate wires to each station. Another offered a complicated and delicate clock-work mechanism which he claimed would give the necessary indications with the use of two wires. After these proposals had been abandoned the following apparatus was devised and installed by D. J. Kerr, the smelter electrician. It is simple, gives accurate readings at any desired point or number of points, and requires but two wires. It can be installed at small cost by any electrician, and thereafter requires no attendance to insure continual service.

### Details of the Indicator.

A float lever the length of which is nearly equal to the diameter of the tank, is attached to the inside of the tank, near the top. Close to the fulcrum end of the float lever is attached an arm carrying a segmental copper strip which makes and breaks contact with 19 stationary copper-contact buttons as the float rises or falls. These buttons are attached to a board opposite the moving segmental strip and are spaced the proper distance apart to make successive connections with the copper strip at each foot rise of the float. The contact buttons are connected in parallel through a lamp resistance to one wire of a 220-volt circuit, and the movable copper strip to the opposite wire. These two wires are run to the different points where indications are desired, and ammeters are connected in the line to give the desired readings. The ammeters are calibrated to give full scale deflection with a current of 5 am. and scale markings are from 1 to 20 consuming 0.25 amp. to each division. At the power-house a recording ammeter is used, thus giving a chart record of the depth of water at all times.




Electrical Indicator for Water Tanks.

When the indicator at the pumping station registers a depth of 18 ft., the pump is stopped and remains shut down until the indicator shows 12 ft. of water in the tanks, which depth is assumed as a minimum supply.

The greater portion of the water is for blast-furnace use, and it was deemed advisable to erect an indicator near the furnaces, for in case of an accident at the pumping plant it sometimes becomes necessary to cut down the water consumption to the lowest possible point, and at such times the indicator is of especial value to the furnace foreman. The recording indicator at the power-house gives a check on the efficiency of the operator at the pumping station.

*Engineering and Mining Journal.

## METALLIC PACKING.

A packing that will pack any class of engine without the design of same being changed is shown in the accompanying illustrations. A prominent feature of this packing is that no stuffing box has ever been designed for it, since

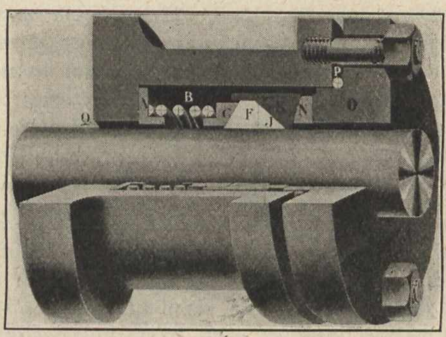
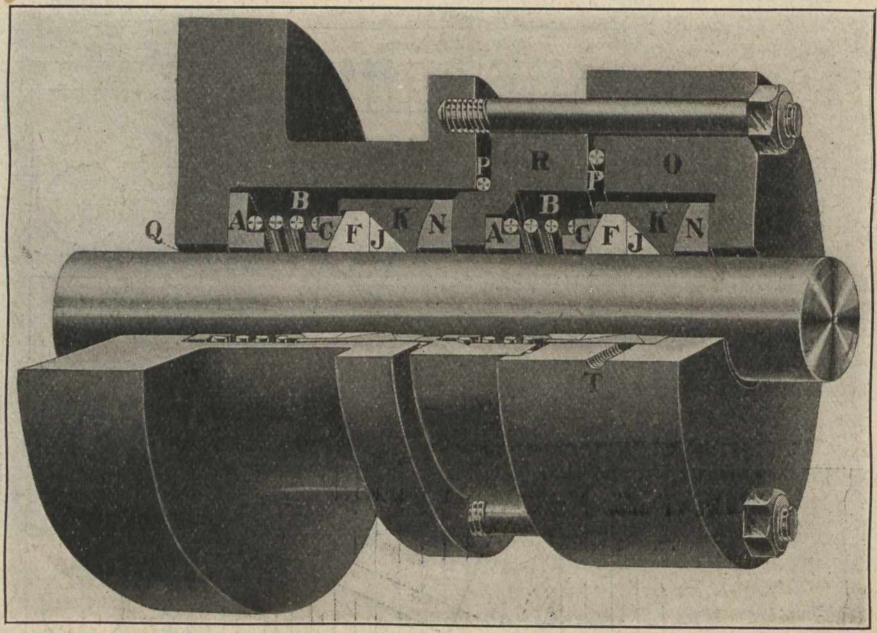


Fig 1. Cook's Metallic Packing.

it is immaterial whether a stuffing box is used at all or not, when this packing is used. The essential qualities of a good metallic packing are to be found in that made by the C. Lee Cook Manufacturing Co., Louisville, Ky. It is of simple construction, will run for a long period with little lubrication and adjustment, and does not wear the rods. This packing is used in some of the largest plants in the United States, and according to the makers, is giving perfect satisfaction.




F.g. 4. Double Packing for Vertical and Condensing Cylinders.

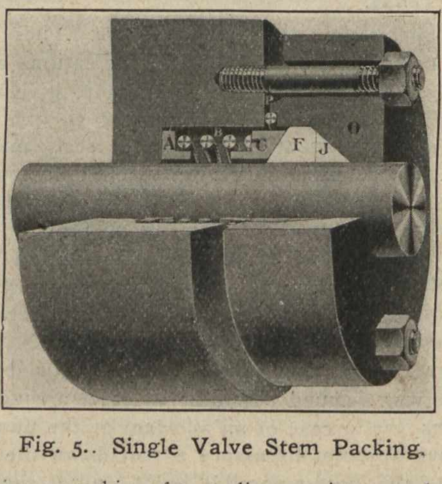
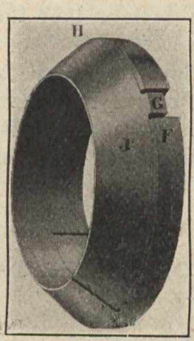


Fig. 5.. Single Valve Stem Packing.

In fig. 1 a packing for ordinary piston rods is shown. The packing rings proper, F and J, are of babbitt metal, held to the rod by the bevel block C, backed up by the spring B. The spring guide A, the first piece put into the box, holds the spring centrally and prevents it from coming in contact with and cutting the rod. The bevel face of the casing K makes a steam-tight joint with the babbitt blocks and is concaved on the other surface to fit the convex face of the ball ring N, forming a ball joint which allows the packing to conform to any deflection of the rod induced



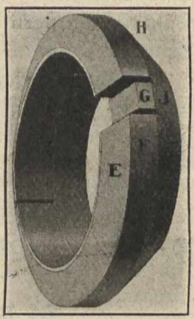


Fig. 2. Fig. 3.
Anti-Friction Babbitt Rings.

by poor alignment. The plane face of the ball ring is a ground joint against the inside end of the gland O. A copper gasket P makes a steamtight joint between the flange of the gland and the face of the stuffing box. Packing in this form is adaptable to any stuffing box and for use with saturated steam not to exceed 150 pounds on horizontal engines. Figs. 2 and 3 show anti-friction babbitt rings F and J upon a larger scale. The beveled face of the follower C fits the beveled face of the lap-joint ring F, which holds it firmly to

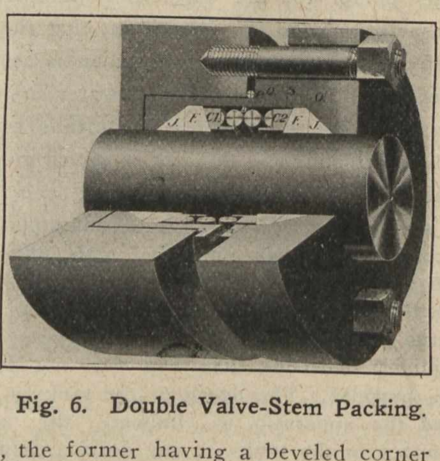


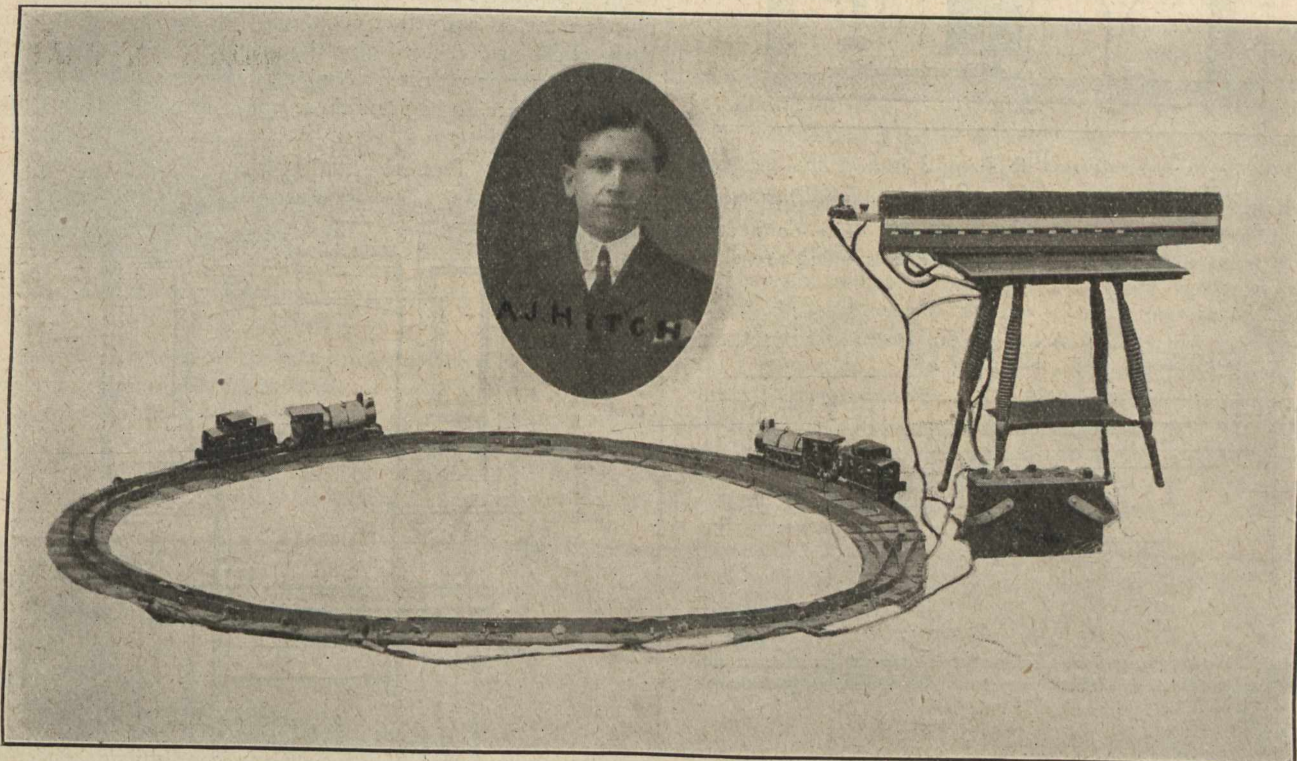
Fig. 6. Double Valve-Stem Packing.

the cone J, the former having a beveled corner H which fills out the remaining taper of the cone ring J. The bevel H of the ring F seals the opening where the cone ring is cut, thus making a steam-tight joint. The long bevel of the cone ring J seals the joint where the lap-joint ring F is cut. There is a lug G, on the cone ring J which serves to hold the joints of the packing rings F and J in transverse section, making it impossible for steam to escape at these points. Enough clearance is cut out of the rings F and J to keep the ends from coming together, which would force the rings from the rod.

Fig. 4, the reference letters of which apply to the parts to which they have been assigned in the previous engravings, shows a double form of the packing used upon the rods of vertical engines and of the low-pressure cylinders of condensing engines where a high degree of vacuum is desired. The set nearest the cylinder serves to hold the steam pressure, while the outer set catches the water and conveys it off through the threaded opening T of the outer gland O. If desired, a drain pipe can can be screwed into this gland and led to any convenient place. In the case of the compound condensing engines a pipe is led from the receiver to the tapped hole T and the receiver pressure acts to balance the atmospheric pressure effectively sealing the vacuum. A globe valve on the pipe can be used to throttle the steam admitted and to permit at the same time the escape of any condensation. Figs 5 and 6 illustrate the packing as applied to Corliss valve stems, the first for non-condensing engines and the other for the condensing cylinders of engines where a high degree of vacuum is to be maintained.

# PREVENTION OF RAILWAY ACCIDENTS.

A young Canadian, whose portrait appears in the accompanying illustration, Albert J. Hitch, of Windsor, Ontario, has invented and patented a railway signal apparatus, which it is claimed will completely revolutionize railway operation, rendering accidents either by collision and derailment at open switches practically impossible. Operators will not be needed at the smaller stations, since it enables dispatchers to send messages to trains without the use of telegraphy. It will also enable him to know at all times where each train is, at what speed it is travelling, and whether the numerous switches are open or closed.




**Know-Hitch Railway Signalling Apparatus.**

The device, which is protected by patents in Canada and the United States, is known as the "Know-Hitch Railway Signalling Apparatus." Many prominent railway men have examined the apparatus, and all are of opinion that it is the most complete arrangement of the kind that has been invented, and in consequence they are much in favor of its adoption. Some are of the opinion that sooner or later the invention will be used on all first-class roads, and already Mr. Hitch has received offers for the purchase of his patent, although it has been made public only a short time.

Mr. Hitch started to work on his invention about four years ago, his original idea being to get up a system which would make electric connection with the dispatcher's office when the train was at certain points on the road, thereby showing its position on the indicator in the office. The inventor has carried out this idea, and has added to it means for protecting open switches, and for sending messages direct to the engineer of the train.

As will be seen from the illustrations the apparatus is not at all complicated, taking into consideration the amount of work it is capable of accomplishing.

For every few miles of road there is a "casing" (Fig. 1) just inside one of the rails, and of the same height. This casing has wires connecting it with the divisional point, and when the train passes over it a message is transmitted on the principle of telegraphy, opening or closing an electric circuit. The "casing" is about the same height as the rails and is set on springs, and beneath the spring plate are the ordinary telegraphic instruments. When the train passes over this casing the flange of the wheel depresses the spring plate, and in so doing completes the circuit, thereby transmitting a message to the dispatcher's office, where it operates an indicator giving the exact position of the train, and at the same time, a distinct telegraphic signal.

This indicator is shown in Fig. 2, and consists of a casing (1) provided with a plurality of openings (2) together with a tablet bearing the indicator proper (7). The "casing" which is placed alongside the track, as already noted, is connected with this indicator, and when the circuit is completed by the train the report is sent in. The indicator proper is white, the red showing when the circuit has been completed and a signal sent in. In the dispatcher's office is hung a map showing the position of each signal point, and the location of each switch, at each of which there are two signal points, having corresponding indicators, which show red when the switch is open.

The second signal at each switch shows red whenever a train is running or standing across the main line, thus

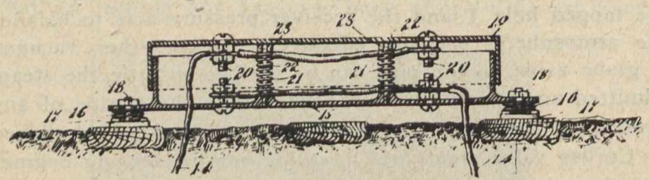


Fig. 1.

giving the dispatcher warning that the main line is not clear, and enabling him to take action accordingly.

The arrangement of the switch signal is shown in Fig. 3. A portion of the indicator in the dispatcher's office is allotted

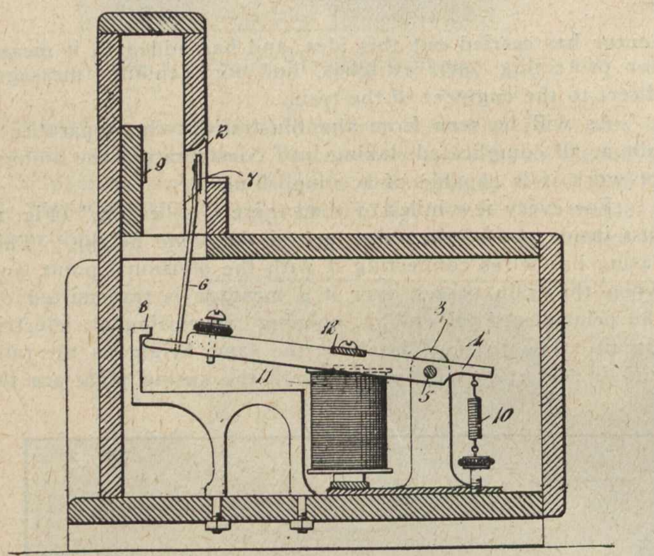


Fig. 2.

to switches, and in this case tablet (9) has the word "open" upon it, and tablet (7) the word "shut." The connections leading from the switch to the dispatcher's office are shown at (25).

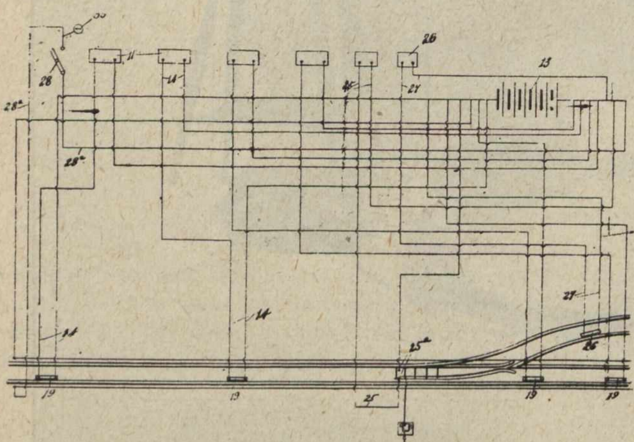


Fig. 3.

The sidings are also equipped with "casings," and for these, the words "clear" and "not clear" appear on the indicators.

**Sending Messages to the Train.**

The system for sending messages to trains is entirely separate, and is done by means of a third rail of a much lighter material than the regular rail. This third rail is placed just outside the usual rails (Figs. 4 and 5), and the locomotive is fitted with trolley wheels that run on the same. These rails are electrically connected, and connections are made with the dispatcher's office that enable him to ring the bell in the cab (29) an incandescent lamp (30) being lighted at the same time. The blocks are placed ten miles apart, and each one is connected with the main office by separate wires, so that the dispatcher can send a message to any particular engineer without sending one to every engineer along that line. When the signal is being sent an electric light in the office shows whether the line is in working order or not.

These two systems combined will give the dispatcher entire control over the line in his section, as he sits before the indicator in the office constantly receiving information as to where every train is, and how fast it is running, together with particulars of all switches. The speed is re-

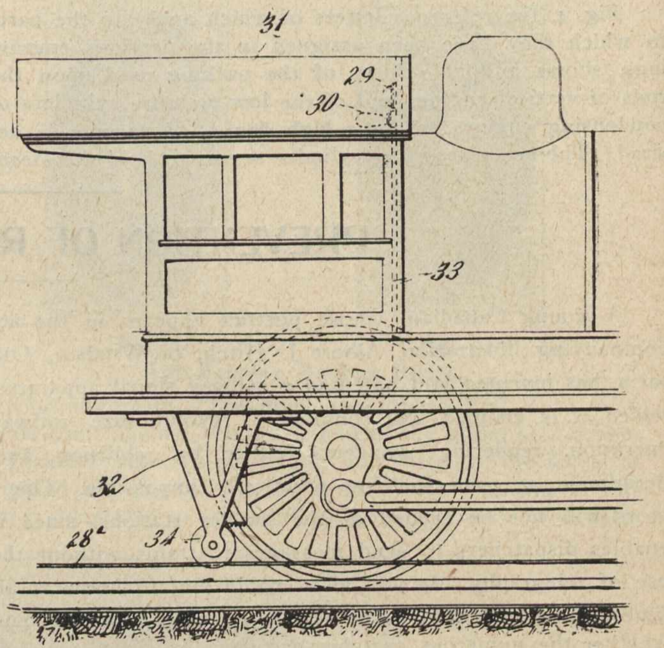


Fig. 4.

corded by clicks, each car passing over the "casing" on the line sending in a distinct click, and the rapidity with which these clicks are received give the dispatcher an idea as to the rate the train is running. A plan is already under way for a counting device to register these clicks accurately, thus mak-

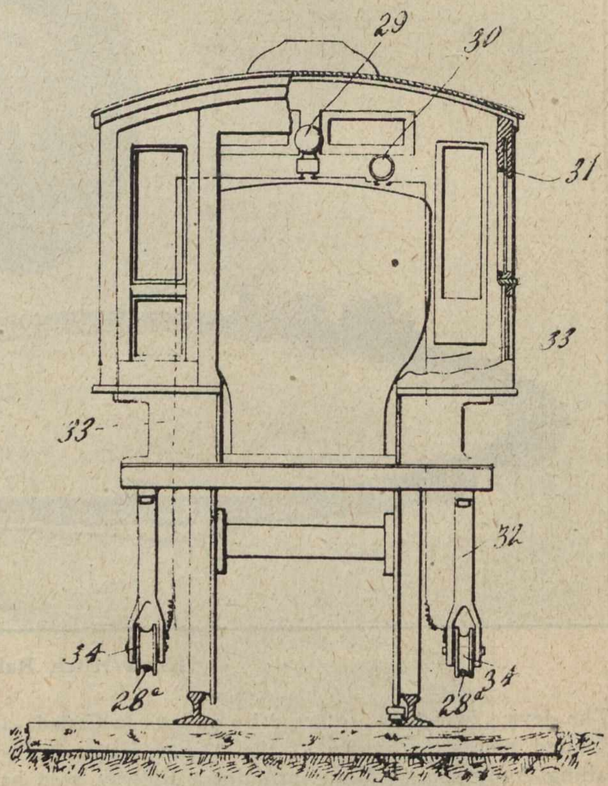


Fig. 5.

ing the information received by the dispatcher absolutely correct.

These two systems are above the surface of the ground, the "casing" and the third rail. Two wires travel from each signal point, and two from each block to the main office. These wires are underground, and it is intended to supply all the electric current necessary from batteries at the main office.

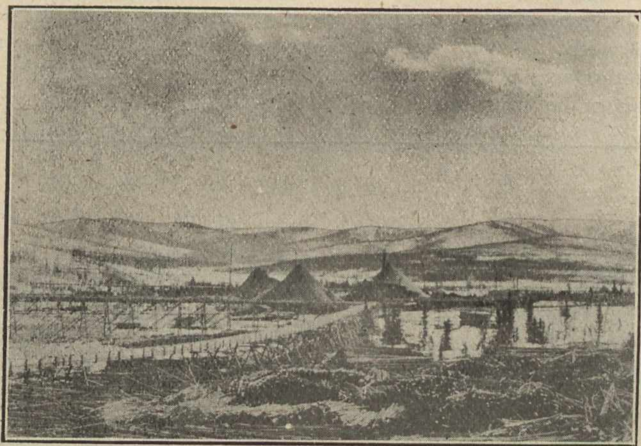
The inventor, who was formerly an operator on the Wabash at Paynes Mills, not far from St. Thomas, believes that the combination system can be put in at a cost not exceeding $4,000 per ten miles of road.

# PLACER MINING IN THE KLONDIKE.

By Joseph B. Tyrrell.*

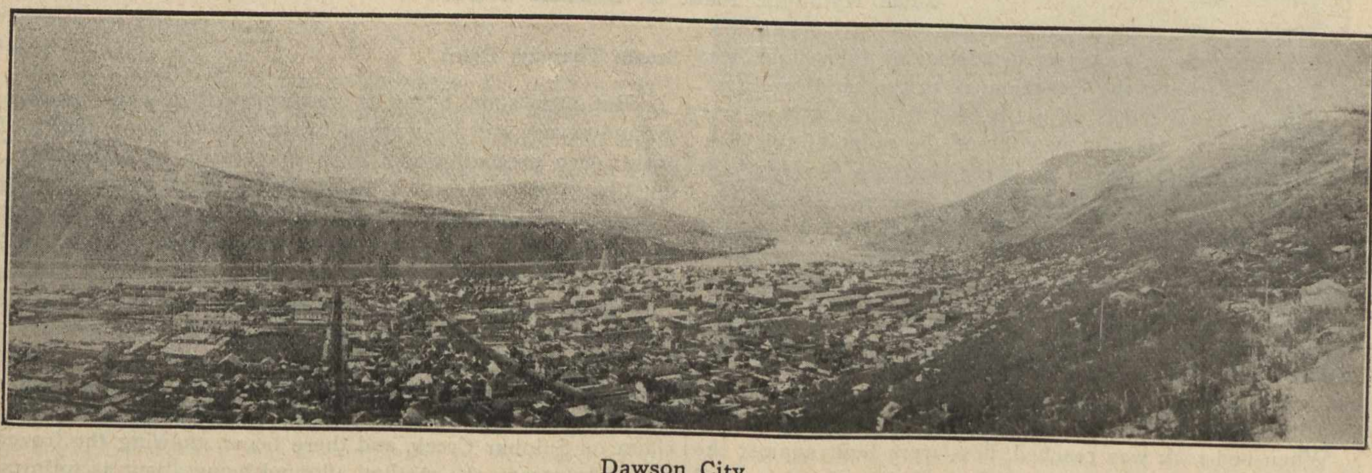
In the summer of 1896, marvelously rich gold-bearing gravels were discovered in the extreme northwestern corner of the Dominion of Canada, almost under the Arctic circle. The region in which the discoveries were made was very remote from the nearest city or centre of civilization, and was practically isolated for the greater part of the year, and although vague rumors of a rich gold strike filtered to the outside world during the following winter, it was not until the summer of 1897, when the steamer from the mouth of the Yukon River, bearing its load of gold, tied up to the wharf in the city of Seattle, that the world learned that a great new gold-bearing country had been discovered in the north.

The miners who reached the golden Klondike, and secured mining claims there, found themselves surrounded by conditions to which most of them were entire strangers. As in other placer camps, the native gold, in nuggets, pellets and dust, was lying free in the alluvial gravel of the streams, and consequently the mining properties were classed as "placer mines," but there was a very vital difference be-



Gold Run Creek Showing Long Flumes and Dumps of Pay-dirt.

tween these mines on the tributaries of the Yukon River and other alluvial mines in countries farther south. The gravel was frozen into a solid mass, and remained frozen summer and winter alike, and at the same time it was almost everywhere covered by a layer, from 2 feet to as much as 100 feet in depth, of vegetable mold or "muck," which was also frozen

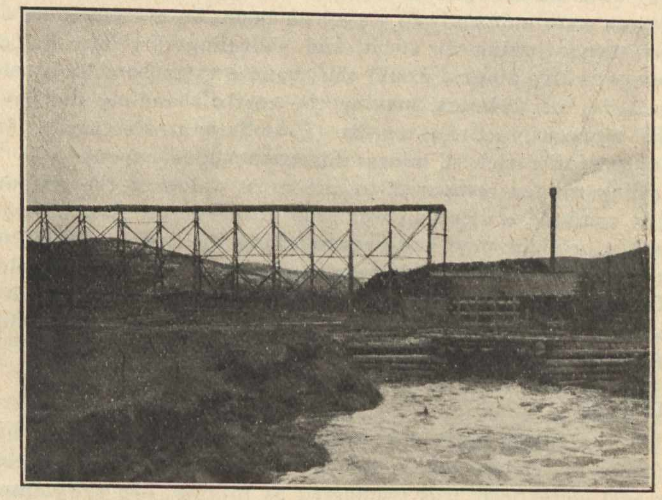


Dawson City.

into a solid mass. The gravel had to be first thawed, and the development of the most economical methods of thawing had been a dominant factor in profitable mining in the Klondike.

For a time imagination and inventive genius seemed to run wild throughout the camp, and almost every claim had its own peculiar methods of procedure. The more important methods that have survived have been described and illustrated by C. W. Purington in his report on "Methods and Costs of Gravel and Placer Mining in Alaska," published by the United States Geological Survey.

For two years, after gold was discovered by George Carmack on the banks of the Bonanza Creek, mining was



Pumping Water for Sluicing.

almost exclusively confined to the gravel deposits in the bottoms of the valleys, and was performed entirely by hand, with the assistance of such simple implements as the pick, shovel, wheel-barrow and windlass. Two general methods of mining were in vogue, depending on whether the claims were worked by a pit or a "cut" open to the surface, or by a shaft or shafts and tunnels or chambers underground.

**Ground Sluices.**

The first method, usually known as "ground sluicing and shovelling in," involved expensive preparation before the pay-dirt could be reached. A narrow ditch was dug in the muck lengthwise of the claim, and a part or the whole of the water of the adjoining brook was turned into the ditch by a wing-dam. The water rapidly deepened the ditch to the level of the bottom of the muck, or the top of the underlying gravel, and men were set to pick down the muck and ice from the sides of the ditch into the running water below, by which it was in part dissolved and in part carried away down the stream. As the ditch was thus widened, the water was kept flowing against one side by little dams, and in this way an area, from 100 to 200 feet in length and 50 feet or more in width, was freed from its covering of muck, and the underlying sand and gravel were laid bare to be thawed by the sun and warm winds and rain of the remainder of that summer or of the following summer.

Of the gravel so exposed, the upper portion usually contained so little gold that it was of no value. It was, therefore, shoveled into wheel-barrows, and wheeled away and

*Mining engineer, Toronto.

dumped to one side, all the ground being removed until the gold-bearing layer near the bed-rock was reached. A dam was then built in the stream some distance above the area of uncovered gravel, which, being now lower than the surrounding part of the bottom of the valley, or than the bed of the stream itself, was known as the cut, and a flume was built from this dam to sluice-boxes, which were strung on a proper grade across the top of the cut. Water was turned into the flume and sluice-boxes, and the pay-dirt was then shoveled, usually in two stages, from the bottom of the cut into the sluice-boxes.

This shoveling-in was a slow and expensive process, for wages were uniformly 6s. (1.50) an hour. An average gang of six men, working in a cut, and shoveling dirt into sluice-boxes in two stages, would thus handle 15 to 20 cubic yards in a day of 10 hours, making the cost of handling the pay-dirt alone from £1. 4s. to 18s. ($6 to $4.50 a cubic yard). In some of the richest mines this tremendous expense was a trifling matter compared to the great value of the output. For example, a clean-up was seen at one mine, after a force of six or eight men had been working for three shifts of 10 hours each, the yield being eight gold pans full of clean gold. The owner, at the time, was obliged by law to pay a royalty of 10 per cent. of this gross output, and the return made by him of the value of this clean-up was £9,000, ($45,000).

**Drifting.**

The other method of mining in vogue at that time, chiefly on claims where the muck and underlying barren gravel were deep, was conducted as follows: In the winter season, a shaft, about 3 x 6 feet in horizontal dimensions, was picked down through the frozen muck to the sand or gravel. As a rule the muck flakes off easily, and much of it is so free from grit that it will not even blunt the point of the pick. As soon as the shaft was sunk to the gravel, a fire was built in the bottom of it, and after this fire had been burned out, and the gases arising therefrom had risen to the surface, the gravel that had been thawed by the fire, extending probably to a depth of from 12 to 18 inches, was dug out and hoisted to the surface with a bucket and hand-windlass. Another fire was then built in the bottom of the shaft, the gravel being afterward removed as before, and so the work went on until bed-rock was reached. One and sometimes two fires were lit in a shaft each day.

When bed-rock was reached, fires were built against the face of the gravel, green timber being piled on the dry wood to keep down the heat as much as possible, and the gravel and bed-rock were hoisted to the surface as before and piled up in a dump. During the following spring, when the water was flowing in the adjoining creek, it was diverted into sluice-boxes and led past the dump the surface of which, as it was thawed by the sun and atmospheric agencies, was scraped off and shoveled into the water in the boxes, the rate at which this pay-dirt could be handled being determined by the rapidity with which the dump thawed.

Exact accounts were rarely kept in the Klondike in those days, except by the banks, so that it is difficult to determine the precise cost of much of the mining that was then done, but it is safe to say that it varied from £2 to £5 ($10 up to $25) and more to the cubic yard.

Some underground mining, with the help of wood fires, could only be carried on in winter, for at that time of year the air in the drifts, though at freezing point, was much warmer and lighter than the air above, which was probably 50 deg. F. lower in temperature, and the noxious gases formed by the fires would quickly rise to the surface and be dissipated.

But the miners were determined, if possible, to prospect and work their claims whether the season was summer or winter, and after a number had been overcome and killed by gas the following plan was adopted:—A shaft was picked down through the frozen muck to the gravel as before, and then a big fire was built on the surface close to the top of the shaft in which a number of large rocks were heated. These were then thrown to the bottom of the shaft and covered with moss or brush. Next day, the moss, brush and rocks, now cool, were hoisted to the surface with a windlass and as much of the gravel as the hot rocks had thawed was also dug up and hoisted, after which hot rocks were again thrown down the shaft and the process was repeated until the bed-rock was reached.

Such were the methods of mining practised in the Klondike in 1897 and 1898, and such are still the only methods available in remote districts to which machinery cannot be transported.

**Small Hydraulic Plant on Bonanza Creek.**

**Steam Thawing Plant.**

But men soon began to recognize that while shallow ground might still be worked by hand with a possibility of profit, deep ground, which must necessarily be undermined, must be thawed in some other way than by wood fires or hot rocks if it was to be mined quickly and cheaply, and that the great majority of the mining claims in the country were underlain by deep ground.

Many plans were suggested and tried, but, so far as the writer is aware, John McGillivray, a mining engineer from San Francisco, California, was the first to adopt the method which has since come into very general use. In the winter or spring of 1899, he took a small steam-boiler to a mining claim on Sulphur Creek, and there began thawing the frozen gravel by steam, the method adopted being about as follows: The shaft was picked down through the muck, and near it the boiler was set up on the surface. A small iron pipe was connected to the boiler and run down to the bottom of the shaft, where it was connected by an india-rubber hose to a loose piece of ½-inch pipe pinched in at the point. Steam was raised in the boiler to a pressure of 20 or 30 lbs. per square inch, a valve which had been set in the pipe was opened, and steam was let into the loose pipe, known as the "point," which was then pushed into the gravel to its full extent, and allowed to remain there for several hours, during which time steam was supplied from the boiler to the tip of the point penetrating into the gravel.

From this little boiler has developed the efficient steam thawing in use at the present day, in so many of the placer mines of the Yukon Territory and Alaska: It consists of a boiler of 25 to 50 horse-power, not too heavy, iron piping, the steam hose, and points, 5 feet or more in length, made of double-thickness hydraulic steel pipe, with a tip of very hard steel in the end of which is a hole ¼-inch in diameter, and a heavy steel head into the side of which is welded a hollow nipple on which the steam hose may be clamped. This

**Dump of Pay-dirt Built with Dawson Carrier.**

point is driven into the gravel or bed-rock with a heavy mallet, the steam being kept up to a pressure of 80 or 100 lbs. per square inch, so that there may be no danger of pebbles or chips of rock wedging in the hole at the tip.

There are many occasions on which the steam thawer is now used, other than for extracting the frost from the pay-dirt in the drifts. Shafts are sunk with it, either by driving short points vertically into the ground and digging out the thawed dirt from time to time, or by driving a long point, from 20 to 30 feet long, vertically down through the muck and gravel to bed-rock, steaming it for a day or two, and then digging out the whole of the thawed dirt at once, making a circular shaft. The dumps of pay-dirt extracted during the winter, and again frozen hard, are thawed in order to enable the miners to make full use of the heavy rush of water in the spring to wash the gold from the gravel. The uncovered gravel in the open cuts is thawed in order to hasten the work in summer, or to prolong the mining into the autumn, etc.

**Pumps.**

In a number of mines, pulsometers are used underground to thaw and break down the face of the gravel in the drifts, the water in the pump being pumped over and over again against the face of the gravel, breaking it down and washing it back a short distance, the process being assisted by a man with a rake, the water being gradually heated by the absorption of the steam into it. In other mines, a similar result is attained by pumping the water with a duplex pump from the pump against the face of the gravel, the water being first slightly heated by steam direct from the steam pipe.

**Dawson Carrier.**

The final and greatest improvement in the mechanical moving of the pay-dirt was accomplished by the invention of the self-dumping cable-tram or "Dawson carrier," carrying a bucket with a capacity of from 9 to 11 cubic feet. By its means one man at the hoisting engine can raise from the shaft, and either pile up in a conical dump, or empty into a sluice-box, as much dirt as eight or ten miners underground can pick down and wheel to the hoisting bucket.

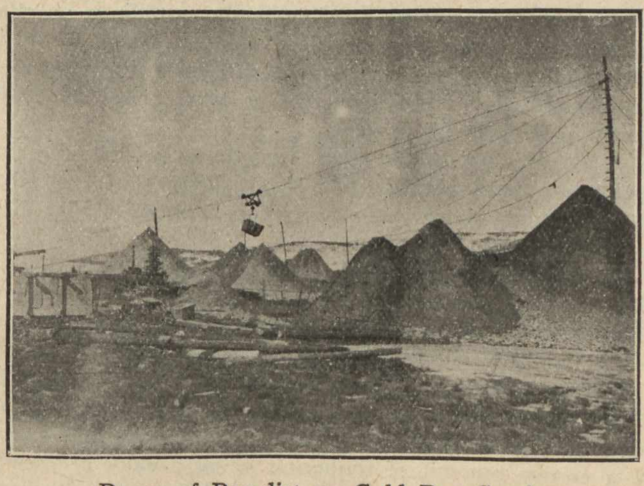
By its assistance, the pay-dirt in solidly frozen ground can be mined from tunnels and drifts, hoisted and sluiced for about 12s. ($3) a cubic yard, with wages at £1 4s. ($6) a day of 10 hours, and dry spruce wood for fuel at £2 ($10) a cord.

**Gold-Washing Plant.**

The gold-washing and separating apparatus in use in the Klondike has remained practically unchanged throughout the life of the camp. Leaving the "rocker" out of consideration, it consists of a string of sluice-boxes each 12 feet long, and 12 or 14 inches wide at the upper end, and two inches narrower at the lower end. These boxes are placed so that the small end of one box just slips into the large end of the one below it, and are supported and braced so as to have a grade of from 6 to 9 inches to each box. In the middle of the string, there is usually one box much larger than the others, called a "dump-box," in which a man stands with a heavy "sluice-fork," to stir the gravel and throw out any rocks too large to run easily through the smaller boxes. In the bottoms of all these boxes, small rounded poles, called "riffles," are laid lengthwise, and are fastened together by short transverse strips every six feet. Water varying in quantity from 250 to 700 gallons per minute is turned into and allowed to flow through the sluice-boxes, and as the pay-dirt is shoveled or emptied into them, it is carried along by the water, and the gold settles to the bottom and is caught between the riffles, while the gravel and sand is discharged from the lowest box at the tail of the sluice. The riffles are raised and taken out from time to time, and while a small quantity of water is allowed to flow through the boxes, the gold is carefully separated with wooden paddles and brushes from the gravel, which was caught with it in the riffles.

**Removal of Barrens.**

The modifications of the methods of open cutting and ground sluicing adopted in 1897 and 1898 have been usually on well-known engineering lines, and have not exhibited the same originally as that evinced in the underground mining methods. Stripping the muck from the gravel is still generally accomplished by diverting the stream into a number of new channels, and picking down the banks. In one instance, the muck was stripped off very successfully by using a force-pump, and directing a stream of water from a small nozzle upon it. In this way, the light vegetable material was washed down into the stream as fast as it thawed, and the whole body of muck was quickly removed. But no one seems to have carried this method of removing muck to its full and legitimate extent, by using water under natural pressure for this work. The water can readily be obtained at sufficient elevation from tributaries of the main streams, and undoubtedly, before long, the only method of stripping



**Dump of Pay-dirt on Gold Run Creek.**

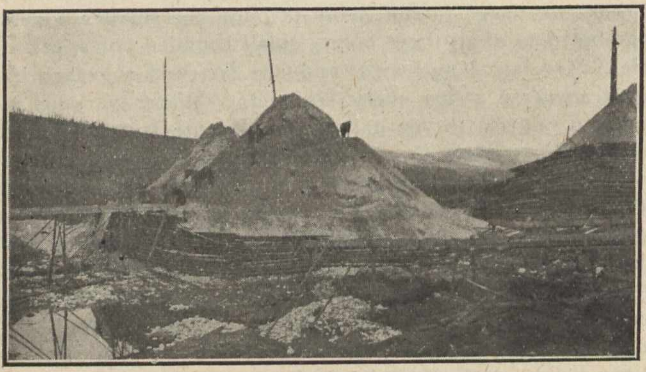
that will be recognized as economical and rational will be by the use of such water delivered under pressure from an hydraulic giant.

**Removal of Pay-Dirt.**

After the barren gravel was removed, the pay-dirt was either shoveled into sluice-boxes set in the bottom of the cut, the water used being afterward raised by a centrifugal pump to the general surface level; or the sluice-boxes were set over the cut, and the pay-dirt was shoveled, usually in two stages, into them; or the sluice-boxes were set above and to one side of the cut, and the pay-dirt was shoveled into wheel-barrows and then wheeled and emptied into a car which was hauled up an incline and its load tipped into the sluice-box; or it was wheeled to a bucket which was hoisted by a swinging derrick; or it was wheeled to and emptied on an india-rubber belt conveyer, which discharged into the sluice-box; or it was wheeled to a bucket which was hoisted by the Dawson self-dumping cable carrier and emptied into the sluice-box. The latter is now much the most common method of conveying the pay-dirt from the mine to the sluice-boxes.

**Hill-Side Claims.**

Comparatively early in the history of the camp, it was recognized that there were gravels rich in gold lying above,



**Scraping Pay-dirt Into Sluice Box With Horse Scrapes.**

and often high above, the present bottoms of the valleys. These were at first attacked with rockers, the water in many instances, being carried up several hundred feet in pails from the creek below. The owner of one of the richer of these claims would often have from six to ten men with rockers working for him, but on account of the great expense of such work no attempts were made to mine ground that would yield less than £3 to £4 ($15 or $20) to the cubic yard.

After the narrow belts or rich and shallow ground along the edges of the benches or terraces had thus been shoveled off and washed in rockers, the miners began to run adits into the hills along the top of the bed-rock, and to bring out the pay-dirt to the "rim" to be washed in a rocker. But this process of mining and hand-washing proved entirely too slow and expensive; so the pay-dirt was mined and brought to the mouths of the adits, where it was piled up for a time, and was then either run in a chute down the hill to a sluice set near the creek, and supplied with water from it, or in the event of its not being possible to dump tailings on the creek claim, a pump was installed, and water was pumped up the hill and allowed to run down again through the sluice-boxes, being often used two or three times over by different parties in its descent.

At a still later date, ditches, sometimes several miles in length, were dug to bring water from tributary streams at a sufficiently high elevation to wash these dumps of pay-dirt from the benches.

The methods of mining adopted on these terrace, or so-called "hill-side" claims, were for the most part very similar in character to those used in underground mining in the creek claims. An adit was run along the top of the bed-rock to the rear boundary of the claim, or as far as pay-gravel could be found, and drifts were driven at regular intervals at right angles to it. The intermediate pillars were then taken out, a certain amount of timbering being usually necessary to support the roof while the pay-gravel from these pillars was being recovered. In most of these mines, the ground was frozen and had to be thawed with steam points; but in some cases, generally where the overburden of barren gravel was more than 200 feet thick, the ground was not frozen. In some instances, however, the claim which the miner desired to work did not extend to the rim, so that it could not be worked from an adit, and in that case it was necessary to sink a shaft and mine in the same manner as in the bottom of the valley, the chief differences being that the shaft was usually deeper, and the expense of obtaining water for washing the gravel was very much greater.

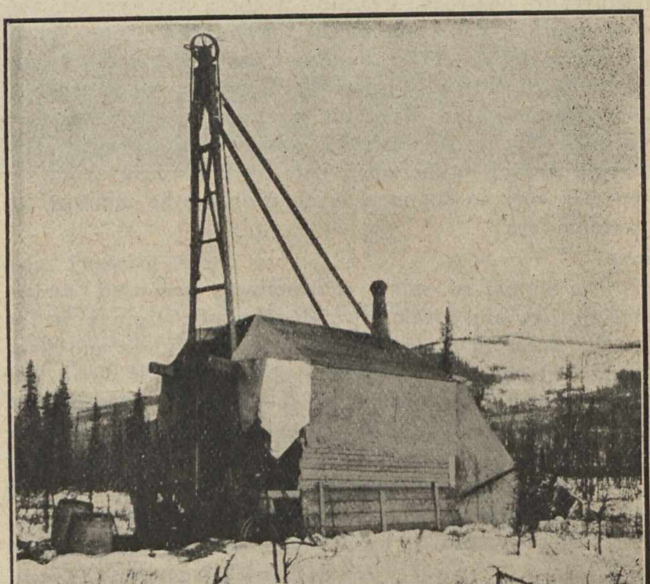
In other instances, after the value of the gravel in these bench deposits had been proved by tunneling, water was pumped up from the creek in the bottom of the adjoining valley to heights of from 50 to 100 feet above the level of this gravel, and was then delivered against it through hydraulic giants, thus washing it off the rocky bench on which it lay, the water with its load of gravel being directed in its flow through cuts in the bed-rock, and then through sluice-boxes. The enormous expense of installing such a pumping plant in a region so remote and difficult of access, and the great cost of fuel after the plant had been installed, soon proved that such a method of mining was too expensive, even for the very rich ground that was being operated upon; but it also proved that hydraulic methods of mining were quite feasible in the Klondike, and that the frost in the ground was no bar to the employment of such methods.

**Ditches.**

Attention was then turned to the problem of obtaining a supply of water by gravity sufficient to enable the miners to carry on effective hydraulic operations on these benches. Most of the ditching accomplished up to the present time has been erratic and disjointed, and has supplied water to the hydraulic giants for but a few weeks in each season; but this correct principle has been recognized, that the proper supply of water is the run-off from the adjoining higher country, and that the most economical way of obtaining water is by collecting this run-off and storing it in reservoirs in the gulches, from which it can be drawn when required.

The average annual precipitation in the Klondike region is between 10 and 12 inches, about 4 inches of this being in the form of snow. Experience has shown that about three-quarters of the snow on the ground in March, and about one-half the rainfall can be figured on as run-off, or, say, in all about 6 inches in the year, equal to 13,939,200 cubic feet of water to each square mile of catchment area, or 6,452 twenty-four-hour miner's inches of water. With a duty of 5 cubic yards to the miner's inch, which is rather below the average so far attained in that country, this quantity of water will wash down 32,260 cubic yards of gravel.

The area of the watershed of Bonanza Creek is roughly 90 square miles, two-thirds of which, or 60 square miles, is well above the level of the highest of the bench deposits,



**Prospecting With Churn Drill on Indian River.**

and the run-off from this extensive tract, if caught and fully utilized, would thus be sufficient to hydraulic away nearly 2,-000,000 cu. yds. of gravel. If to this were added the run-off from 40 square miles of hills drained to the Yukon River, which could readily be brought round into the valley of Bonanza Creek at a considerable elevation, the total quantity of water so made available would be sufficient to wash down more than 3,000,000 cubic yards of gravel each year.

**Dredging.**

One other plan of gravel-mining on a large scale, dredging, is only applicable to the low-lying alluvial deposits in the bottoms of the valleys. There are now five dredges in the Klondike, all built on the ladder-and-bucket principle, and more are being installed. They handle all the gravel, and, if properly managed, save very nearly all the gold, at a very much lower cost than the material can be handled in any other way, except with a hydraulic giant, where there is abundance of water and dumping ground. They are under the disadvantage, however, of not being able to work in frozen ground. In one case, this difficulty was overcome by thawing the ground with long steam-points in front of the dredge, but this added enormously to the cost of the work, and practically excluded the possibility of mining very much of such low-grade ground as would pay handsome profits elsewhere. The absence of large boulders makes the gravel very easy to move with a dredge when it is free from frost, and the air will quickly take the frost out of the gravel, if the muck which almost everywhere covers it is removed.

The cost of alluvial mining in the Klondike has gradually decreased from the time of the discovery of the camp ten years ago until now, and mining claims that were once valueless have two or three years afterward, with improved methods of mining, yielded fortunes to their owners. He would be a rash man indeed who would say that even the best methods of placer mining now in use cannot be improved upon, and it is not improbable that ten years hence, when the enormous cost of the mining of the past few years has been forgotten, and when methods of handling gravel are still further improved upon, men will wonder that miners could have ever passed over and neglected such rich gold-bearing deposits as are now lying unworked in the Klondike.

## CONCRETE AQUEDUCT NEAR FORT WILLIAM.

The Kaministiquia Power Company will, as soon as the weather permits, start the construction of an additional reinforced concrete aqueduct or pipe at their hydro-electric power development at Kakabeka Falls on the Kaministiquia River, near Fort William, Ont. The plans and specifications have been prepared by Mr. J. A. Jamieson, C.E., Montreal, and the work will be carried out under his direction as consulting engineer for the company. This is considered a very important piece of work, and probably the largest of this type, length and diameter considered, that has ever been constructed, being approximately a mile and a quarter long, 10 feet 6 inches exterior diameter, and will be under considerable pressure throughout its length.

One of the most difficult problems in the construction of a reinforced concrete pipe is to obtain watertightness, and, as the original pipe has not proved entirely satisfactory in this respect, the engineer has prepared a radically different design and system of construction, one of the leading features of which will be the producing of a watertight skin on the interior surface, mechanically bonded to the concrete shell. The results obtained by this new process will no doubt be watched with considerable interest by engineers throughout the country.

## SCHOOLS AND FIRES.

To the Editor of the "Canadian Engineer":

Sir,—As a civil engineer I would make a suggestion as to fire escapes which I think will be recognized as common-sense and practical. An outside iron ladder is not very sure to be serviceable. It may happen to be in the worst situation when the fire occurs. The real necessity is a place of refuge which will be safe for some considerable time after a fire breaks out. It is time that is the essential. The best plan, therefore, is to have an iron gallery extending completely around school buildings at each floor; every schoolroom to open on these galleries by a glass door or French windows down to the floor. The ordinary windows could also be used for escape. School buildings are almost all isolated, which admits of this plan. When a building is on fire, the greater part of the flame comes out on one or two sides. By running around these galleries to the windward side of the building, persons could stand in safety against the walls, between the windows, for probably half an hour, giving ample time for rescue when the fire ladders arrive. In most cases security could be found on some side of the building till the whole interior was gutted, as it is seldom that the walls fall in buildings of moderate height.

The advantage of galleries extending entirely around the building is thus evident. In case of fire, the rule would be: Keep the inside room doors shut, and leave by the windows. This is usually a necessity, whether there are fire escapes or not, as the stairways and passages are almost always the first to fill with smoke and flame, which makes it impossible to run around the interior of the building to look for the ordinary fire ladder.

The galleries should be made of iron bars, suitably spaced, with railings of still more open iron work. This would allow snow to pass freely through them, so that they would never be blocked. It might be desirable to connect the galleries on the different floors with iron ladders; but their use would be uncertain, as the fire might be worst where they happen to be placed.

So long as it remains an axiom that every building is built to burn, it is only common sense to face the question: What will happen when it does burn? The suggestion here made is thus only ordinary foresight, especially in the case of schools.

W. BELL DAWSON.

## FINANCIAL RESULTS OF AUSTRALIAN RAILWAYS, 1905-6.

The complete figures showing the working of the Australian railways in 1905-6 are now available. The gross earnings of the railways expanded by $4,757,053 from $57,319,037, to $62,076,891. On the other hand, working expenses rose by only $630,323, from $35,765,989 to $36,402,933. The net revenue, therefore, improved by no less than $4,156,005, from $21,897,857 to $26,053,862. The total net revenue, therefore, of $26,053,862 leaves a surplus after paying all interest, etc., of about $2,581,100, which is the first time for a considerable number of years that the lines have made a profit. The following comparison is of interest:—

| | |
|---|---|
| 1902-1903, deficit | $7,048,351 |
| 1903-1904, deficit | 3,556,561 |
| 1904-1905, deficit | 1,955,305 |
| 1905-1906, surplus | 2,581,100 |

The improvement effected, as compared with the previous year, is about $4,536,405, while as compared with 1902-1903 the results are almost $13,740,000. So far the 1906-7 returns have shown further gains on the past financial year's figures, and it is tolerably clear that a considerable addition to the profit earned during the past twelve months will be made.

## TRAINED ASSISTANTS NEEDED.

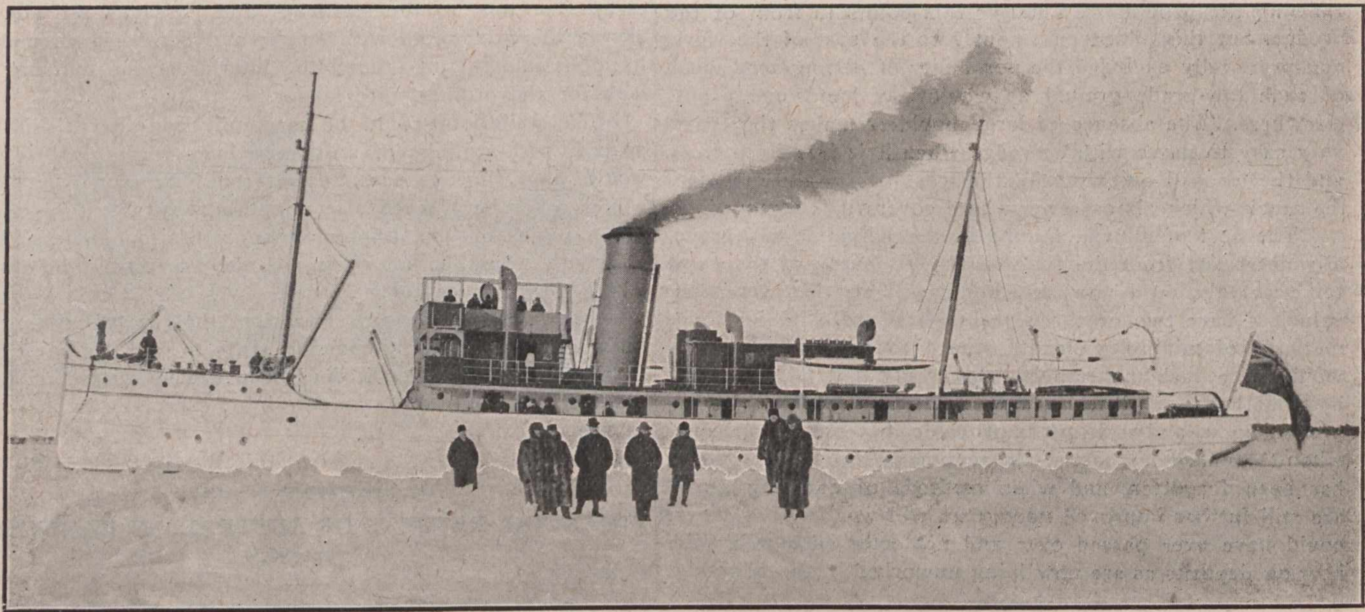
Technical education and the conversion of waste matter into profitable by-products, were the subjects of consideration at a meeting in Montreal of the Society of Chemical Industry, in which representatives of the Canadian Manufacturers' Association took part. There was a dinner at the St. Lawrence Hall, at which Dr Hodgson Ellis, of Toronto, presided, and there were interesting addresses by the chairman and by Professor R. F. Ruttan, of McGill University, the former of whom gave an historical sketch of the growth of chemistry in the last century, while the latter spoke on the "Destructive Distillation of Sawdust."

The Executive Committee brought before the meeting for endorsation the co-operation of the Society with the Canadian Manufacturers' Association for the appointment by the Federal Government of a Royal Commission to report on the best method of establishing a comprehensive national system of technical education to provide Canadian industry and commerce with trained assistants from amongst the Canadian people.

## THE CANADIAN GOVERNMENT ICE-BREAKER, "LADY GREY."

A new type of ice-breaking steamer has recently been acquired by the Canadian Government. The "Lady Grey" is intended for service on the St. Lawrence, and will be used for keeping the river open during the winter months.

The vessel, which was constructed by Messrs. Vickers Sons & Maxim, Limited, of Barrow-in-Furness, is a special type and is built unusually heavy. The craft measures 172 feet in length; moulded breadth, 32 feet overall; depth, 18 feet; normal draft, 12 feet; draft when engaged in ice-breaking, 13 feet; displacement, 1,055 tons; indicated horse-power, 2,300; speed, 14 knots per hour.



**The Canadian Government Ice-Breaker, "Lady Grey."**

The bow is designed for mounting and breaking through green ice, and also for forcing its way through pack ice. Great strength is assured to the hull by carrying a broad bel of heavy plating for a considerable distance above and below the waterline right fore and aft. In order to overcome nipping of the hull, through the lateral pressure of the ice, special attention has been paid to the cross-sectional form of the boat, athwartship pressure being additionally counteracted by double framing, formed by the introduction of intermediate channels. Right forward at the point where the vessel first strikes the ice these additional members extend from the keel to the main deck, while in the after section they are fitted between the bilge and the main deck. Moreover, the side plating is also increased in thickness from the stem to a point well aft of amidships.

The hull is divided into six watertight compartments, while there is a double bottom extending from the forward to the after-peak bulkheads. The compartments forward and aft of these bulkheads are arranged to serve as deep ballast tanks, for the purpose of varying quickly the trim of the vessel, in order to assist it in riding up on the ice to permit the superimposed weight to break up the ice. These tanks are connected by means of a large pipe to powerful ballast pumps, so that the water can be quickly discharged from one into the other as required.

The propelling machinery comprises two sets of vertical direct-acting triple-expansion, surface-condensing engines developing 2,300 indicated horse-power when running at 130 revolutions per minute. The high-pressure cylinders are of 19 inches diameter, the intermediate cylinders 30 inches, and the low-pressure cylinders 49 inches; with a stroke of 27 inches. Steam is raised in a battery of four single-ended cylindrical boilers 10 feet 6 inches long by 12 feet 9 inches diameter, and steam is supplied at a working pressure of 180 pounds per square inch. The furnaces are fired by means of the Jones mechanical underfeed system, with fans for the air supply. The propellers, of which there are two sets provided, are three-bladed and of the built-up type. One set is specially designed for ice-breaking work, while the other is reserved for use in summer.

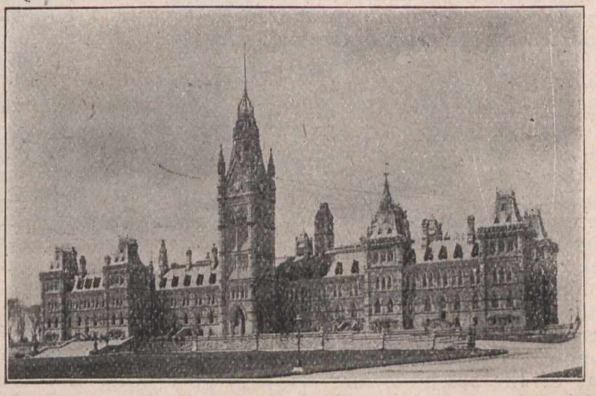
A notable feature is that although essentially intended for ice-breaking service the boat has been so designed as to be capable of fulfilling other equally important functions during the period it is not required for ice-breaking. Powerful pumps and other requisite gear are supplied so that the craft may be utilized for salvage operations; she may also be employed for towing purposes, for which the power of the engines renders the craft admirably suited, and special gear for this class of service is carried. Futhermore, the boat is to be employed by the Marine and Fisheries Board for survey work upon the coast and the channels in navigable waters. For this occupation the vessel is provided with a very complete outfit and ample accommodation for the staff and crew. A complete electric lighting plant is installed, and a searchlight of 16,000 candle-power is carried.

**The "Lady Grey," Looking Aft.**

## A NEW THEATRE.

As a town grows, its demand for warehouses, schools, churches, increase; and places of amusement for the people increase also. Toronto has five theatres, and is growing so much that enterprising managers determine she must have two more. One of these, on King Street, west of Simcoe, is already far advanced, and the plans of another, to be called The Gaiety, are being completed. Apparently it will be the most attractive of all in an architectural sense, for the front is very graceful. The material of the building is cream stone for the first storey, with buff brick and stone dressings for the higher ones. The style is an adaptation of the Renaissance and the façade will be highly embellished.

# INTERNATIONAL PATENT RECORD

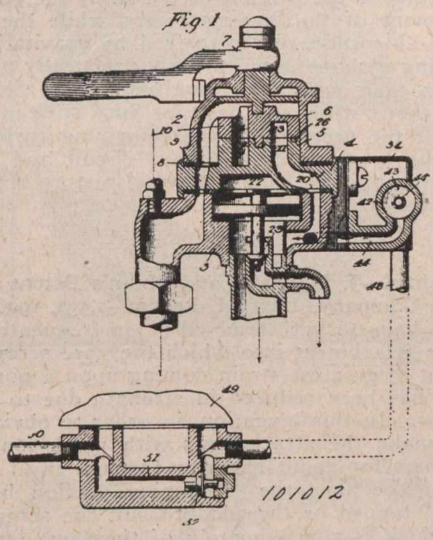


Dominion Houses of Parliament.

## CANADIAN PATENTS.

Specially compiled by Messrs Fetherstonhaugh, Dennison and Blackmore Patent Attorneys Star Bldg., 18 King St. W., Toronto; Montreal and Ottawa.

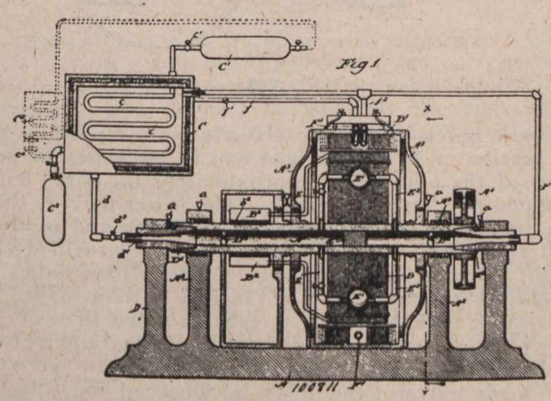
**Engineer's Brake Valve.—J. A. Hicks.—101,012.**—An arrangement of passages through the portion of the valve connected to the operating handle whereby the engineer may on a certain movement apply the brakes on the engine without affecting the general train line, and by a further movement,



101,012.

affect the said train line. A bye pass operating in one direction is placed in the train line so that any application of the brakes through accident to the main train line will automatically apply the engine brakes.

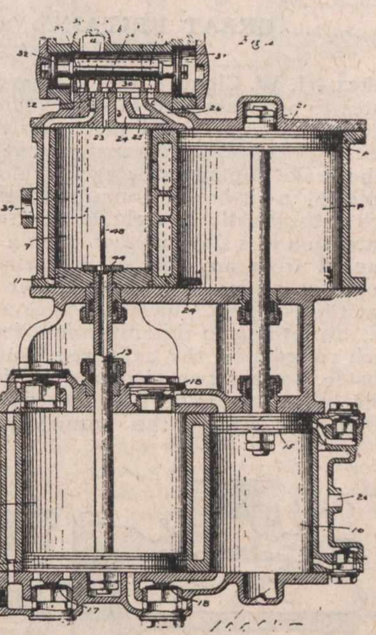
**Cooler for Electric Generator.—Benson Bidwell.—100,811.**—The invention consists in mounting the armature on a hollow shaft and having circulating pipes connected



100,811.

from said hollow shaft to a cooling chamber formed in the body of the armature. The central passage in the hollow shaft is blocked centrally and propellers arranged in each side to force the fluid through the chambers. The ends of the shaft are connected with a cooling reservoir, and suitable circulating pipes are run through the fields.

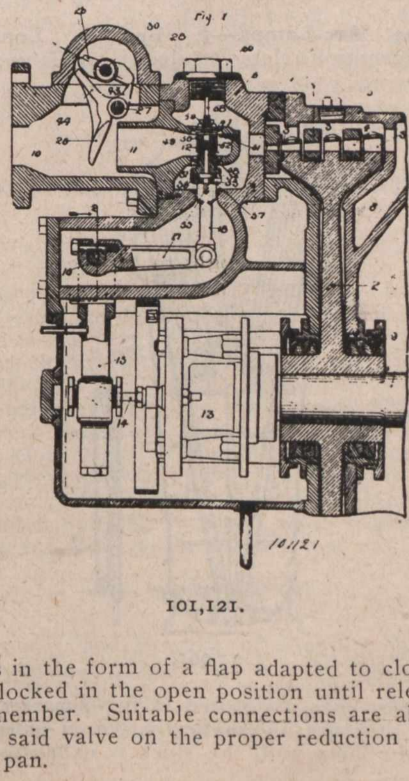
**Steam Pump.—The Canadian Westinghouse Company.—100,978.**—The invention consists in arranging high and low pressure cylinders adjacent one to the other with suitable valves controlling the inlet to both cylinders, and a low pressure pump cylinder arranged in line with the high pressure



100,978.

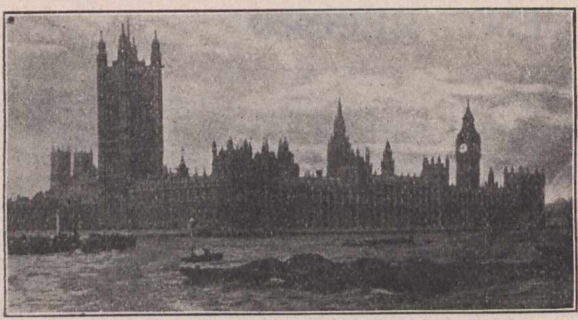
engine cylinder, and a high pressure pump cylinder in line with said low pressure engine cylinder. An auxiliary reversing valve is also provided which is actuated by the high pressure steam piston and controls the movement of the main distribution valve.

**Governor for Turbines.—The Canadian General Electric Co.—101,121.**—The device consists essentially of an emergency valve actuated from the rotor member so that on the said rotor member attaining an excess of speed the valve will be swung to close the inlet to the turbine wheel.



101,121.

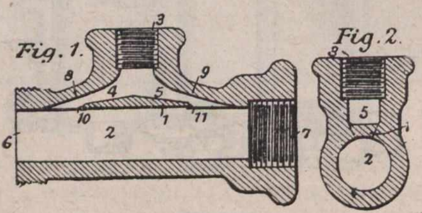
The valve is in the form of a flap adapted to close the inlet, and is held locked in the open position until released by the said rotor member. Suitable connections are also arranged to open the said valve on the proper reduction of the speed of the rotor pan.



British Houses of Parliament.

## GREAT BRITAIN.

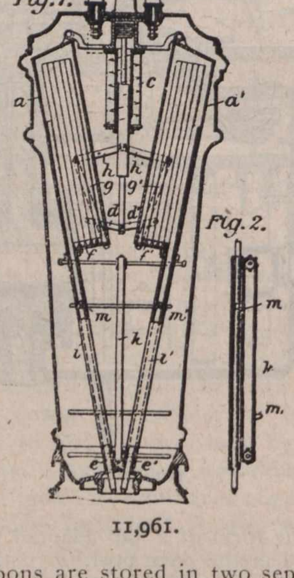
**Air-Brakes.—J. W. Cloud, London.—3,411, 1906.**—This invention relates to air-brakes for railway vehicles, and has for its object to provide improved T-pieces for the main conduit whether such are needed, as, for instance, at the branch pipe leading to the brake apparatus on each vehicle. An ordinary T-piece employed in air-brakes comprises a straight tube having a branch substantially at right angles thereto; and with such a construction it is obvious that when a rapid movement of air is caused from any two of the orifices towards the third, or from one orifice towards the other two, eddies will be formed at the junction, which will have a retarding effect on the flow. According to this invention, for the purpose of avoiding such retardation, the improved T-piece is constructed with a baffle, so that two channels are formed from one orifice to the other two orifices at the ends of the straight part of the T. The sides of the channel and baffle are suit-




3,411.

ably curved and rounded off, so as to interfere as little as possible with the flow of air between the branch and the straight part, whichever may be the direction of the current through the junction. 1 is the baffle provided between the main passage 2, and the branched passage 3, so as to form two channels 4 and 5 leading in opposite directions from the branch orifice 3 to the respective orifices 6 and 7 of the main passage. The walls 8 and 9 of the channels 4 and 5 respectively are suitably curved, and the extremities 10 and 11 of the baffle 1 are rounded so as to interfere as little as possible with the flow of air between the branch 3 and the main passage 2, whichever may be the direction of the current through the junction.

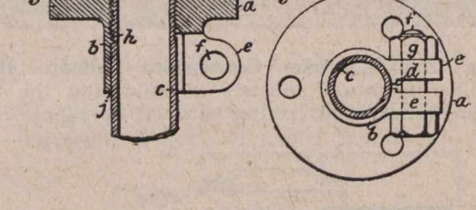
**Magazine Arc-Lamps.—J. Brockie, London.—11,961, 1906.**—This invention relates to electric arc-lamps of the type




11,961.

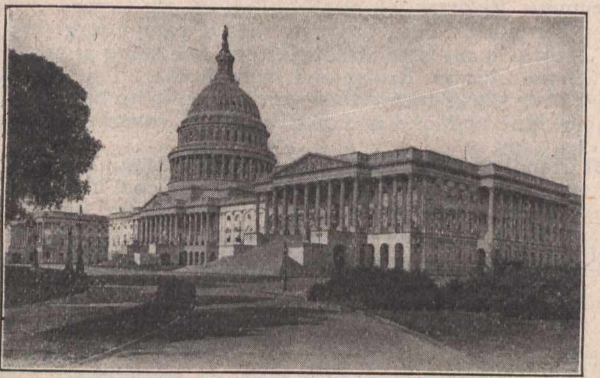
in which the carbons are stored in two separate receptacles, from which they are automatically fed in pairs during the burning of the lamp until the stock is exhausted. The invention consists in an improved construction of such apparatus which ensures the positive feeding of both burning carbons by a single engaging member or tappet as they are consumed, and the supply of the additional carbons in regular succession under the action of gravity only. The magazines *a*, $a^1$ containing the spare carbons are pivotally supported on the lamp-frame and connected with the core of a main solenoid *c* by means of links *d*, $d^1$, so that as the core moves toward or away from the centre of the solenoid the magazines and their attachments will be turned about the pivots, and consequently the burning carbons *e*, $e^1$ caused to recede from or approach each other. The magazines are provided with movable bottom plates *f*, $f^1$, which are linked with the core of the solenoid *c*, so that when the main circuit is broken the plates *f*, $f^1$ will be tilted or shaken so as to assist the gravitation of the spare carbons towards the outer sides of the magazines. The bottoms *f*, $f^1$ of the magazines are hinged at their outer ends and have their inner ends connected by links *g*, $g^1$ with levers *h*, $h^1$ which are fulcrummed in the lamp-frame, and are connected with the core of the solenoid, so that when the main circuit is broken the movement of the solenoid core will not only bring the carbons *e*, $e^1$ into contact, but will also raise the inner ends of the hinged bottoms *f*, $f^1$ of the magazines. Secured to the magazines are tubular carbon guides *i*, $i^1$, having at their lower ends spring fingers, through which electrical connection is made between the carbons *e*, $e^1$ and the external circuit. Between the carbon-tubes is arranged an endless band *k*, which is driven by a motor, the operation of which is governed by the pressure of the arc in the well-known manner, and carries laterally projecting tappets *m*, $m^1$ adapted to engage the rear ends of the burning carbons *e*, $e^1$ for which purpose the guide-tubes *i*, $i^1$ are partly cut away longitudinally, and to feed them towards the arc equally and simultaneously as they are consumed. It will thus be seen that the burning carbons alone, owing to the friction of the contact fingers, encounter considerable resistance to feeding movement, and this is overcome in the present invention by the positive driving engagement of the feeding device, while the remaining carbons are able successively to feed by gravitation in rear of the burning carbons, since there is practically no frictional resistance to their movement longitudinally. Should, however, the carbons which are next for duty stick in the guides by reason of the pressure of the remaining carbons in the magazine, the breaking of the main circuit and the consequent shaking up of the magazines will restore normal working conditions.

**Pipe-Joints.—J. H. Mann and Mann's Patent Steam-Cart and Wagon Company, Limited, Leeds.—1,539, 1906.**—Screwed pipes which have to withstand vibration frequently break off close to the attachment into which they are screwed, caused by the point of greatest strain coming upon a portion of the pipe which has been reduced in strength due to the cutting of the screw. In this invention, in order to obviate this the applicants make the attachments with much longer bosses, and bore them for about half-way through to fit the outside diameter of the pipe, the remaining portion being bored smaller and tapped or threaded to suit the screwed end of the pipe, which is approximately of the same length as the threaded portion of the attachment. *a* indicates the flange, and *b* the boss of same. This boss is bored about half-way through on the side on which the pipe *c* is introduced, to fit the outside diameter of the pipe. The remaining portion of




1,539.

the boss is bored of smaller diameter, and tapped or threaded to receive or fit the screwed end of the pipe, the screwed portion of the pipe being approximately the same length as the tapped portion of the boss. The lower part of the boss, which surrounds the unscrewed part of the end of the pipe, is split at one side, as indicated at *d*, and is provided close to the split opening with two lugs *e*, which have holes to receive the tightening-up bolt *f*. In case of large pipes it may be advisable to have the boss split in more than one place, and to have a corresponding number of lugs and tightening-up bolts to suit each. After the pipe has been screwed into position, the nut *g* of the bolt *f* is tightened up, firmly clasping and staying the end of the pipe *c* so that the point of greatest strain is not, as is usually the case, at *h*, the weakest place, but at *j*, where the strength of the pipe has not been reduced by screwing.



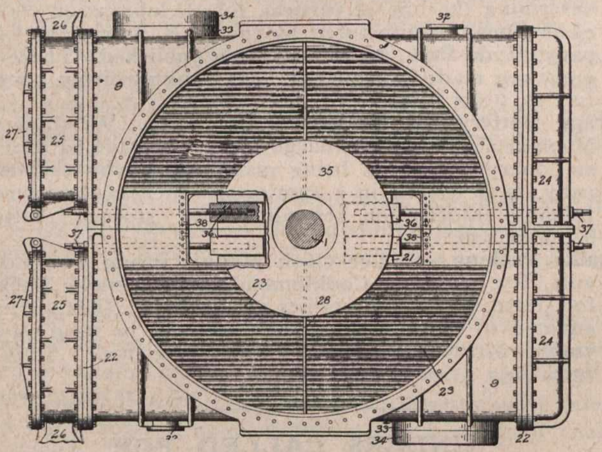
Capitol, Washington, U. S. A.

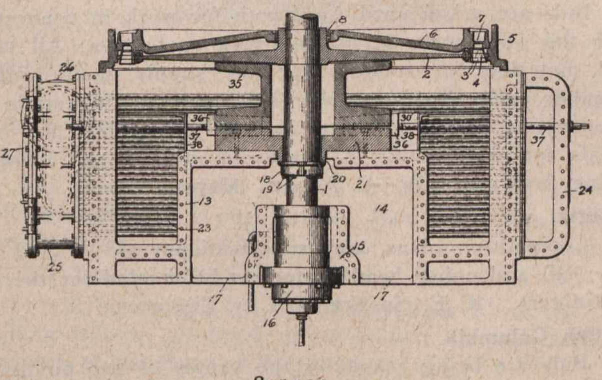
## UNITED STATES PATENTS.

Specially selected and abridged by Messrs Siggers and Siggers, Patent Attorneys, 918 F. Street, N. W., Washington, D.C., U.S.A.

**Surface Condenser for Turbines.—William L. R. Emmet. Schenectady, N. Y.—845,294, 1907.**—This invention relates to surface condensers for elastic-fluid engines, and especially to turbine-engines having upright shafts.

The object of the invention is to embody the condenser in one structure with the turbine in order to save space and material and obtain economical results.





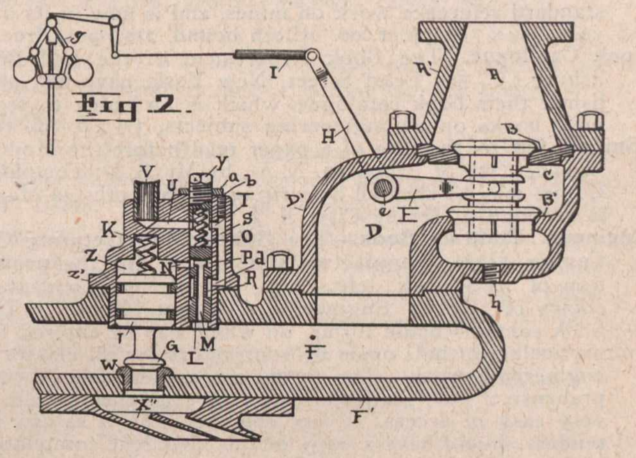
845,294.

It consists of a base comprising a rectangular box-like structure having a step-bearing in its lower part, a circular opening in the top, a wheel-casing mounted on top of the said structure and discharging into the opening, and condenser-tubes located within the structure and below the opening and arranged in two parallel sets.

**Governing Means for Turbines.—Charles W. Drake. Grand Rapids, Mich.—845,058, 1907.**—This invention relates to governing means particularly adapted for governing and controlling the supply of fluid to elastic-fluid turbines.

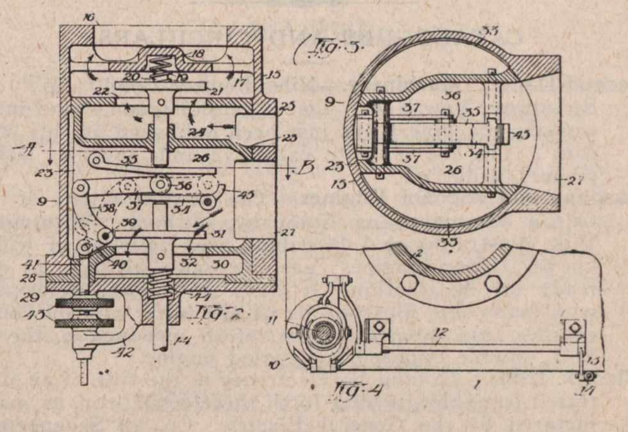
The objects of this invention are, first, to provide an improved automatic means for supplying fluid to elastic-fluid turbines; second, to provide a construction of valves in series which will be controlled automatically in proportion to the varying pressure whereby the steam-supply will be controlled by opening and closing the different valves of the series of sets of nozzles, and, third, to provide an improved means of regulating the pressure at which the nozzles of such a series will open.

It comprises a nozzle-valve; a chamber surrounding the same; a piston in a suitable cylinder connected to said nozzle-valve for controlling the same; a piston-valve controlled by the pressure of the elastic fluid in the chamber surrounding the nozzle-valve, with ports arranged to connect to the said valve-piston cylinder to admit and exhaust the elastic fluid therefrom; and a spring for holding said nozzle-valve normally closed.




845,058.

**Gas-Engine.—William K. Andrew, Milwaukee, Wis.—845,159, 1907.**—This invention relates to gas-engines, generally and specifically to means for governing the volume of explosive mixture admitted thereto without changing the proportions of gas and air comprising said mixture.



845,159.

It consists in providing a valve mechanism adapted to regulate the supply of gas and air, which mechanism is controlled by a governing device operatively connected with a moving part of the engine, and means for adjusting the valve mechanism in a manner to vary the proportions of air and gas as desired.

## MATHEMATICAL INSTRUMENTS.

It seems almost unnecessary to make any mention of the products of Messrs. W. F. Stanley & Co., Limited, of London, England, so well-known are they amongst engineers and draftsmen the world over. This week the Canadian Engineer has been favored with a copy of their latest catalogue, which sets forth very extensively the various instruments manufactured by this company. It is printed on the best coated paper, and the numerous illustrations are of a very excellent character. The book is bound in stiff board covers, with cloth back. It should be in the hands of every dealer in surveying and drawing instruments, as well as every surveyor and engineer throughout the country. Colleges will find it particularly useful when recommending instruments to students, 5½-in. x 8½-in., pp. 150.

—The theory and practice of graphite lubrication is based upon the incontestable fact that the smoother bearing surfaces can be made the less will be the friction between them and the easier will they be to lubricate.

## NEW PUBLICATIONS.

**The Progress Reporter.**—Published each month by the Niles-Bement-Pond Co., 111 Broadway, New York, is a paper that will be found valuable to every user of machinery. The illustrations it contains are excellent, 9 x 12, pp. 20.

**The Mining Manual for 1907.**—By Walter R. Skinner, London. W. R. Skinner, 11-12 Clements Lane. This is a standard reference work on mines, and is now in its 21st year, 4¼ x 7½, pp. 1,600. Cloth bound, 21s., post free.

**Book Catalogue.**—The Book Department of the Hill Publishing Co., 505 Pearl Street, New York, have just published their book catalogue, which is an index to technical books on all engineering subjects, 3½ x 6, pp. 168.

**"Smooth-On"** is the title of a paper read before the Modern Science Club of Brooklyn, N. Y., by Mr. S. D. Tompkins. Copies may be secured by writing the Smooth-On Manufacturing Co., Jersey City, N. J.

**Engineers' Contract Book.**—The Goheen Manufacturing Co., Canton, Ohio, manufacturers of paints for the protection of steel work, etc., are issuing complementary copies of "Zevy's Engineers' Contract Book." This book contains blank forms, on which can be entered full particulars of bids made by contractors for all classes of engineering work. The forms are extraordinarily comprehensive, and particulars entered thereon would be very easy of access. Every engineer who is calling for tenders should have a copy of this excellent compilation of forms, even if it were only used as a guide in recording information. The Goheen Manufacturing Company advise us that they will be pleased to forward a copy to anyone mentioning "The Canadian Engineer."

**The First Report of Meerschaum Company of America** has been issued and can be had upon application at the offices of the company, 25 Broad Street, New York City. The company owns the only deposits of pure commercial meerschaum in the world (outside of the Turkish Government mines of Asiatic Turkey, a monopoly. Owing to the finding of this large deposit in New Mexico it will take first place in the electrical and mechanical world, and in the arts.

## CATALOGUES AND CIRCULARS.

**Second-Hand Machinery.**—Niles-Bement-Pond Co., 111 Broadway, New York. List No. 13 of second-hand metal working machinery has just been published by this company. The list is quite extensive and includes lathes, planers, drills, etc.

**Gasoline and Alcohol Engines.**—The new catalogue of the Gilson Manufacturing Company, of Port Washington. Wis., illustrating and describing their full line of widely known Gilson engines, gasoline—gas—alcohol, is now ready for distribution. It gives a complete description with many fine illustrations of air, water and oil cooled engines, and describes their latest production, the 5½ H.P., double opposed, air-cooled engine.

**Electric Irons.**—Ironing by electricity is the title of an illustrated pamphlet, setting forth the electric iron, as manufactured by the General Electric Co., of Schenectady, N. Y., for whom the Canadian General Electric Co., Toronto, are the Canadian agents, 3½ x 6, pp. 8.

**Cold-Sawing Machines.**—The High Duty Saw and Tool Co., Eddystone, Pa. This catalogue describes and illustrates 14 styles of High Duty Cold-Sawing Machines, together with saw blades to suit. These machines are adapted for all classes of work, and will be found especially useful in railway and structural work, 4 x 6½, pp. 48.

**High-Speed Steel.**—Z. Beardshaw and Son, Limited, Baltic Steel Works, Sheffield, England, publish a booklet entitled "Notes on High-Speed Steel," which contains much valuable information on this subject. The paragraphs on the treatment of the steel are particularly interesting, 3¼ x 4¾, pp. 32.

**Graphite Paint.**—The Joseph Dixon Crucible Co., Jersey City, N.J., have issued a very handsome picture postal card, showing in colors the City Investing building, now in course of construction in New York City. The structural steel work in this building is being protected from corrosion with Dixon's silica graphite paint.

**Machine Tool Holders.**—Armstrong Bros. Tool Co., Chicago, Ill. Tool holders for turning, planing, boring, slotting, threading, cutting off and drilling metals, together with other machine shop specialties are shown in catalogue No. 14, which also contains a price list, 3½ x 6, pp. 80.

**Fuel Economizers.**—The Green Fuel Economizer Co., Matteawan, New York. "How to save 15 per cent. of the coal in making water gas," sets forth the Green Fuel Economizer, giving figures which show the advantages to be derived from their use, 6 x 9, pp. 8.

**The Pittsburgh Automatic Vise and Tool Co.,** Pittsburgh, Pa., manufacturers of vices for all purposes, send us a unique blotter, on which they say, "If we only knew how to get at you we would simply 'eat up' your work." The Pittsburgh swivel vise turns in any direction.

**Pneumatic Riveters.**—John F. Allan, of 370 Gerard Avenue, New York, N. Y., has published a pamphlet giving two records made with Allan riveters, one being at the works of the Chicago Bridge and Iron Works. The test shows that 13,589 ¾-inch rivets were driven in 10 hours, by one machine and one operator. All the rivets were good, 3 x 6, pp. 3.

**Coal Handling Machinery.**—The Jeffrey Manufacturing Co. send us two pamphlets describing coal-handling machinery for use in the power plant. Several installations made by the company are illustrated, 6 x 9.

**Light Locomotives.**—A pamphlet recently issued by the American Locomotive Company illustrates and describes light locomotives, steam and conpressed air, adapted for the use of contractors, mines, logging roads, plantations and industrial plants, and for a wide range of service on light rails and poor road bed. It contains 31 illustrations of different designs and types and tables giving the principal dimensions of designs of progressive weights and hauling capacities of the types illustrated. The last part of the pamphlet is devoted to engineering data and contains a number of very useful tables and formulae.

**Direct Current Motors and Generators.**—Pamphlet No. 4002, published by the Allis-Chalmers Co., Milwaukee, Wis., is descriptive of their direct current motors and generators, type "K," 3½ x 6¼, pp. 4.

**Rock Drills.**—The Canadian Rand Drill Co., Montreal. "Y" is the title of a booklet, which tells "why" the rand drill is being used extensively in most of the mining districts of Canada, as well as elsewhere.

**Wire Brushes.**—The American Wire Brush Co., 25 Broad St., New York, N. Y., manufacture wire brushes for nearly every purpose. Their products are described and illustrated in a 16-page pamphlet, 6 x 9.

**Vertical Engines.**—The revised edition of bulletin No. 125, describing the line of vertical, forced lubrication enclosed engines, manufactured by the B. F. Sturtevant Company, Hyde Park, Mass., has been published. These engines are made in eighteen sizes, ranging from 5 x 5 to 12 x 10, 6½ x 9, pp. 8.

**Storage Battery for Stationary Use.**—The Westinghouse Machine Co., East Pittsburgh, Pa. A storage battery for stationary service is being manufactured by this company, is described in a catalogue which contains much valuable information regarding the storage battery, 6 x 9, pp. 30.

**Metallic Packing.**—C. Lee Cook Manufacturing Co., Louisville, Ky. Messrs. Cook manufacture metallic packing for steam, gas or air engines of all kinds. It is specially adapted to heavy duty service, and can be used on any engine without change of design being made. It is set forth in a 33 page catalogue.

## TENDERS CALLED FOR.

**Ontario.**

Bids are asked until April 20th for work in connection with the waterworks at Maple Creek as follows: All labor and materials for constructing the supply main, intake chamber and collecting pipes. All labor and materials for constructing the distribution system. All labor and materials for constructing a reinforced storage and compensating reservoir. W. A. Abbott, Mayor.

**Alberta.**

Competitive plans and specifications are invited for city hall and police headquarters to be erected for the city of Calgary. R. E. Speakman, City Engineer.

**British Columbia.**

Bids are being asked for the supply of two pumps for the Victoria waterworks at Elk Lake. Mr. Raymur is Water Commissioner.

Tenders are invited for the erection of a pier at English Bay for the Stanley Park Commissioners. Parr & Fee, Architects, Vancouver.

Bids are being asked by the C.P.R. for the erection of building and supply of machinery for the new power-house in connection with the Empress Hotel at Vancouver.

One of the most progressive firms in Canada is the Mechanics' Supply Co., Quebec, who have for the last fifteen years been introducers of the very best in telephone apparatus. If you wish to get in touch with them, see their attractive advertisement in our columns.

## INDUSTRIAL NOTES.

**Ontario.**

The Hamilton Steel and Iron Company is making arrangements to double its big plant here. The company has taken out permits for new buildings to the value of $350,000, and work will be started at once.

A new breakwater is to be built at Port Arthur for the protection of the Atikokan Iron Company's blast furnace plant. Ore docks will also be built. Mr. Hogan is the contractor.

**Quebec.**

The question of building large car shops in Quebec City is under discussion. A deputation waited on the Hon. S. N. Parent recently, and he believed the undertaking would meet with success.

**Nova Scotia.**

The Robb Engineering Co., Amherst, have recently received orders from the Canadian Fairbanks Co., Montreal, for two 45 and one 65 H.P. boilers of the Robb-Mumford type. Also one from the Kitchener Lumber Co. for a large mill, consisting of one 100 H.P. engine, a 100 H.P. boiler, rotary mill, gang edger, etc.; and from Shaw Brothers, Dauphin, Man., for a 100 H.P. automatic engine.

The sixth annual meeting of the Nova Scotia Steel and Coal Company was held in New Glasgow on Wednesday, March 27th. The attendance was small. Mr. Cantley's report for 1906 showed that the plant of the company was in a high state of efficiency, and development work at their mines well up to the standard. President Harris spoke regarding the future policy of the company. He stated that there was sufficient ore in sight at Wabana mines to supply the blast furnaces at Sydney mines for twenty-five years.

**United States.**

A shipment of double-swivel vises has just been made to Cologne, Germany, by the Pittsburgh Automatic Vise and Tool Co., of Pittsburgh. This company is continually receiving foreign orders for their product.

The name of the Sawyer-Man Electric Co. has been changed to the Westinghouse Lamp Co. It has, of course, been generally understood for some years past that the Sawyer-Man Electric Company was a Westinghouse interest, and the change of name is but a logical result of changed conditions.

## NEW BUILDINGS.

**Ontario.**

The General Brass Co. will erect a $9,000 factory on Stirling Road, Toronto.

**Quebec.**

The present general hospital at Montreal is to be demolished and a new one, to cost about $500,000, will be erected on the same location.

The Montreal Branch of the Canadian Bank of Commerce will be constructed by the Canadian White Co. The building will be the finest of its kind in Canada, with the exception of the Bank of Montreal.

## TRADE INQUIRIES.

The following inquiries relating to Canadian trade have been received at the Canadian Government Office, 17 Victoria Street, London, S. W.:—

A Sheffield firm manufacturing all kinds of railway, mining and contractors' tools, tramway tolls, boring and screwing machines, stocks, dies and taps, etc., are open to hear from Canadian buyers or representatives who could undertake the sale of such goods in the Dominion.

An English firm manufacturing electric, hydraulic, or hand travelling cranes, wharf cranes, electric runways, capstans, winches and crabs, electric lifts and machine tools suitable for engineers, bridge builders, boiler makers, etc., is desiring of hearing from Canadian buyers of these and similar goods.

## MUNICIPAL.

**Ontario.**

Hamilton's Fire and Water Committee is asking for permission to issue debentures for $62,000 for the following work: New mains, $28,000; services, $16,000; sandsucker, $12,000; meters, $4,000; valves, $1,000.

A concrete bridge is to be built at Buckhorn, near Peterboro. A portion of the cost will be paid by the Dominion Government and a portion by the county.

**Quebec.**

The Mount Royal Assurance Company has entered an action, claiming the recovery of $8,959.69 from the town of St. Louis. This amount represents the sum paid by the company to policy-holders in consequence of the big fire of September last. It holds the municipality responsible for this loss on account of its not having been in a position to prevent the conflagration. The corporation of St. Louis calls the Montreal Water and Power Company in warranty on the ground of the want of proper water pressure.

**British Columbia.**

The district of North Vancouver invites applications for the position of municipal engineer. Applications must be made not later than the 15th of this month, and sent to the Municipal Hall. Alex. Philip, C.M.C.

## RAILWAY.

Calgary is going into the question of a municipally-owned street car service, and it is considered likely that the proposition will be passed by the city council shortly. Engineer R. E. Speakman has prepared estimates of the proposed works.

## MARINE.

The American Shipbuilding Co. is to have competition in the form of a Canadian plant to be established at Fort William. United States capitalists identified with the marine interests of the lakes are at the back of the project, and if present plans carry the works will be ready for business in less than a year. The promoters will, it is understood, invest $500,000 as working capital over and above the cost of construction, thus making the enterprise a $2,000,000 proposition. The company possibly will be known as the Canadian-American Shipbuilding Corporation.

## CONTRACTS AWARDED.

**Ontario.**

The Goldie & McCulloch Co. have secured the contract for the elevator machinery in the new 2,000,000 bushel elevator being erected by the Dominion Government at Port Colborne.

The contract for the large railway wharf at Souris, Prince Edward Island, has been awarded to E. A. Wallberg, of Montreal. The wharf will be built of reinforced concrete.

The Niagara Falls Foundry Co. have received from Hamilton the contract for supply hydrants at $40.50 each.

**Manitoba.**

The C.P.R. have placed a contract with the Souris Construction Co. for the building of thirty section houses and twenty stations.

**Saskatchewan.**

Prince Albert has awarded the contract for the new electric plant.

The Canada Foundry Co. were awarded the contract for the machinery, and the Murphy Electrical Co., of Winnipeg, the contract for electrical supplies. The price was about $28,000 and take the old plant.

**Nova Scotia.**

S. M. Brookfield, Limited, Halifax, have been awarded the contract for a brick building, 45 by 80 feet, four storeys high. The price is in the vicinity of $45,000. Work is to be finished by October.

## MINING.

**Ontario.**

Superintendent Geo. Kielty, of the Gordon-Cobalt, reports that a complete plant has been ordered for this property. It consists of a 55 horse-power return tubular boiler, a 40 horse-power engine, drills, etc. This plant has been ordered from the Levy, Weston & McLean Machinery Co., of Front Street, Toronto, and will be shipped at an early date. Mr. Kielty says that a good find has been made, and that as soon as the machinery is installed twenty-five men will be kept at work.

**British Columbia.**

Plans are under way for the installing of a blast furnace at the Brown-Alaska Co.'s smelter on Prince of Wales Island by Mr. T. Kiddie, whose system has been installed at the Tyee smelter at Ladysmith.

## NEW INCORPORATIONS.

**Ontario.**—The Cleopatra Mining Co., Ottawa, $2,000,000. L. B. Jennings, New York, N. Y.; D. S. Sawyer, J. T. Hammill, J. B. Bedard, J. S. Virtue, G. R. Lipsey, J. Radley, Ottawa.

Manchester Cobalt Mines, Toronto, $450,000. F. B. Allan, A. Cohen, F. E. Ellis, M. Bray, B. E. Moore, Toronto.

Cobalt Blue Silver Mining Co., Toronto, $1,000,000. J. G. Shaw, J. Montgomery, W. R. Williams, G. F. Thompson, M. Laidlaw, Toronto.

Shamrock Silver Co., Toronto, $1,000,000. J. G. Shaw, J. Montgomery, W. R. Williams, G. F. Thompson, M. Laidlaw, Toronto.

Milburn Cobalt Silver Mines, Peterborough, $200,000. S. T. Medd, W. S. Davidson, G. L. Hay, E. S. Clarry, E. B. Fowler, Peterborough.

The Strathcona Silver Mining Co., of Cobalt, Toronto, $800,000. R. T. Mullin, J. P. Beaudoin, C. I. Giroux, J. Black, Montreal; Francis Watts, Toronto.

The Asbestos Manufacturing Co., London, $25,000. E. W. Phillips, U. S. G. Funk, H. V. Everham, R. V. Mattison, Sr., R. V. Mattison, Jr., Ambler, Pa.

The Elk Lake Cobalt Silver Mining Co., North Bay, $1,000,000. N. B. Strong, H. D. Graham, G. C. Legge, C. H. Graham, E. L. Munro, Haileybury.

Gurry Patents, Hamilton, $40,000. W. D. Long, G. H. Bisby, G. F. Glassco, E. Gurry, F. W. Gates, P. D. Crerar, Hamilton.

Commercial Travellers Larder Lake Gold Mining Co., New Liskeard, $500,000. J. Matthews, M. W. Herron, F. E. Pitts, S. Read, S. M. Herron, New Liskeard.

Red Rose Mining Co., Toronto, $600,000. L. R. Berg, New York, N. Y.; P. H. Kane, F. W. Maclean, S. J. Arnott, M. Perkins, Toronto.

Erie Portland Cement Co., Toronto, $1,000,000. L. A. Landy, D. Forrester, R. D. Moorhead, R. L. Johnston, C. J. Foster, Toronto.

The Bracebridge and Muskoka Lakes Telephone Co., Bracebridge, $10,000. P. A. Smith, P. Hutchinson, J. Thomson, A. U. Smith, M. A. Hutchison, C. M. Thomson, Bracebridge.

The Vandorf Telephone Co., Vandorf, $10,000. G. J. VanNostrand, A. J. VanNostrand, H. Powell, Toronto; G. H. Powell, J. A. M. VanNostrand, Whitchurch Township.

Confederation Mines, Hamilton, $250,000. W. Marshall, J. Thomson, A. T. Freed, W. Barr, A. J. Barr, Hamilton.

Rabbit Mountain Mines, Toronto, $3,000,000. S. J. Marchalleck, J. C. Wilgar, R. H. Cuthbert, J. F. Hollis, A. S. Belcher, Toronto.

The Haileybury Silver Mining Co., Haileybury, $50,000. C. T. Young, T. H. Connor, G. T. Hamilton, C. F. McPhee, Haileybury, R. Herron, New Liskeard.

Cullen Cobalt Mines, Toronto, $1,000,000. E. Cullen, E. W. Warfield, New York, N. Y.; A. A. Bond, F. J. Mitchell, J. R. Skill, Toronto.

Hiawatha Cobalt Silver Mining Co., Ottawa, $1,000,000. J. Arkley, W. W. Boucher, D. H. McAllister, A. H. Walsh, M. McAllister, Ottawa.

The Tidman Silver and Aluminum Works, Toronto, $40,000. H. D. McCormick, F. A. Lewis, D. A. Rose, E. Gillis, M. W. Mayhr, Toronto.

Cobalt Crystal Silver Mines, Toronto, $50,000. S. Johnston, A. J. Thomson, R. H. Parmenter, V. Moffatt, H. V. Reed, Toronto.

Southwestern Oil and Gas Lands, Petrolea, $60,000. D. Urquhart, H. W. Page, B. W. Essery, E. Alexander, C. J. Wallace, O. Wallace, M. E. McIntosh, Toronto.

The Canadian Fire Extinguisher Co., Toronto, $40,000. F. M. C. Dickson, J. Murphy, W. Lauder, F. J. Dunbar, Toronto.

The Jessop Prospecting and Mining Co., Toronto, $1,000,000. F. A. Lewis, E. Gillis, D. A. Rose, M. W. Mayhr, Toronto. W. A. Marsh, Cobalt.

Federal Mines, Toronto, $6,000,000. J. B. Holden, A. Mearns, F. L. Whatley, G. E. Hewson, F. G. Phillips, W. D. Hortin, Toronto; T. J. Harwood, Mattawa.

The Petrolea Bridge Co., Petrolea, $40,000. J. Fraser, T. Johnstone, L. Craise, I. Greenizen, Petrolea; W. H. McKenzie, Port Huron, Mich.

Beaver Consolidated Mines, Toronto, $1,500,000. M. MacDonald, M. F. Pumaville, A. L. Bitzer, G. Grant, A. Dods, Toronto.

Cobalt Concentrators, Toronto, $500,000. G. R. Sproat, C. P. Carlebois, J. T. White, E. J. Black, H. Ferguson, Toronto.

Big 4 Larder Lake Mining Co., Toronto, $1,000,000. J. E. Day, J. M. Ferguson, E. V. O'Sullivan, M. Donevan, H. Jewell, Toronto.

Bonanza Larder Lake Mining Co., Haileybury, $1,000,000. J. E. Day, J. M. Ferguson, E. V. O'Sullivan, M. Donevan, H. Jewell, Toronto.

The Knickerbocker Cobalt Mines, Toronto, $550,000. S. Johnston, A. J. Thomson, R. H. Parmenter, V. Moffatt, H. V. Reed, Toronto.

The Toronto Automobile Co., Toronto, $40,000. J. S. Tomenson, C. H. McArthur, B. Browne, A. A. Miller, D. Donald, Toronto.

The North Bay Cobalt Silver Mining Co., North Bay, $300,000. P. J. Finlan, Cobalt; J. Bourke, P. Bourke, T. J. Bourke, A. G. Browning, North Bay.

Electrical Specialties, Toronto, $300,000. A. C. McMaster, G. R. Geary, F. D. Byers, O. F. Taylor, F. H. Lytle, Toronto.

The Hamilton and Fort William Navigation Co., Hamilton, $1,000,000. W. Southam, A. E. Carpenter, J. Milne, C. E. Doolittle, G. L. Staunton, A. B. MacKay, G. Hope, Hamilton.

Canada Consolidated Cobalt Syndicate, Toronto, $1,000,000. J. M. Ewing, A. G. Ross, W. S. Edwards, M. L. Gordon, J. F. H. McCarthy, Toronto.

James Mines, Toronto, $25,000. W. R. P. Parker, G. M. Clark, J. A. McEvoy, G. Russell, Toronto.

The Hillman Copper Co., Sault Ste. Marie, $60,000. T. W. Trotter, H. A. McKinnon, W. Calder, E. J. Ewing, Sault Se. Marie; A. MacIntyre, Steelton.

England's Premier Cobalt Mining Co., Toronto, $1,100,000. J. T. Richardson, D. C. Ross, L. B. Spencer, P. B. Wood, E. V. O'Brien, Toronto.

The Big 3 Silver Mining Co., Toronto, $2,000,000. H. L. Burns, T. A. Silverthorn, E. M. Carruthers, F. H. Potts, A R. Bickerstaff, Toronto.

The Lucky Strike Cobalt Silver Mining Co., Cobalt, $3,000,000. F. A. Lewis, A. D. McCormick, D. A. Rose, E. Gillis, Toronto.

Floyd Silver Mines, Toronto, $2,000,000. W. H. Blain, J. Fisher, Toronto.

The Cobalt Certainty Silver Mines, Toronto, $2 000,000. H. L. Burns, T. A. Silverthorn, F. H. Potts, A. R. Bickerstaff, Toronto.

American Consolidated Mining Co., Toronto, $500,000. J. M. Ewing, A. G. Ross, W. S. Edwards, M L. Gordon, J. F. H. McCarthy, Toronto.

Winnipeg-Cobalt Prospecting and Development Co., Kenora, $500,000. F. W. Rimer, R. H. Hayward, G. A. Henson, Winnipeg; W. W. Fryer, J. O'Reilly, Selkirk, Man.

**New Brunswick.**—Canadian Antimony Co., St. John, $250,000. N. Crowe, North Brookfield, N. S.; A. S. Baker, London, Eng.; C. J. Coster, J. H. A. Fairweather, H. H. Brittain, St. John.

**Dominion.**—The King Electrical Works, Montreal, $30,000. E. F. Surveyer, A. Chase-Casgrain, J. W. Weldon, E. M. McDougall, S. J. Le Huray, Montreal.

T. Pringle and Son, Montreal, $250,000. E. Languedoc, W. J. Henderson, A. C. Calder, J. Jenkins, A. Savard, Montreal.

The Colonial Engineering Co., Montreal, $125,000. V. E. Mitchell, E. F. Surveyer, A. Chase-Casgrain, J. W. Weldon, S. J. Le Huray, Montreal.

Dominion Quarry Co., Montreal, $20,000. L. C. Rivard, R. Delfausse, J. G. Avard, E. L. Rivard, A. B. Dufresne, Montreal.

Dominion Electric Manufacturing Co., Montreal, $20,000. P. Lahee, A. Morin, A. R. Hall, Montreal.

The International Steel Co. of Canada, Montreal, $500,000. A. R. Oughtred, Montreal; R. W. Gibb, Westmount; M. A. Phelan, E. G. Place, S. C. Marson, Montreal.

Phœnix Mines, Montreal, $200,000. R. T. Heneker, A. H. Duff, J. A. Walker, L. De K. Stephens, W. S. Johnson, Montreal.

**Manitoba.**—Canada West Manufacturers, Winnipeg, $50,000. G. Bingham, J. A. Cowan, W. J. Cummings, R. S. Barrow, F. E. Cantwell, Winnipeg.