

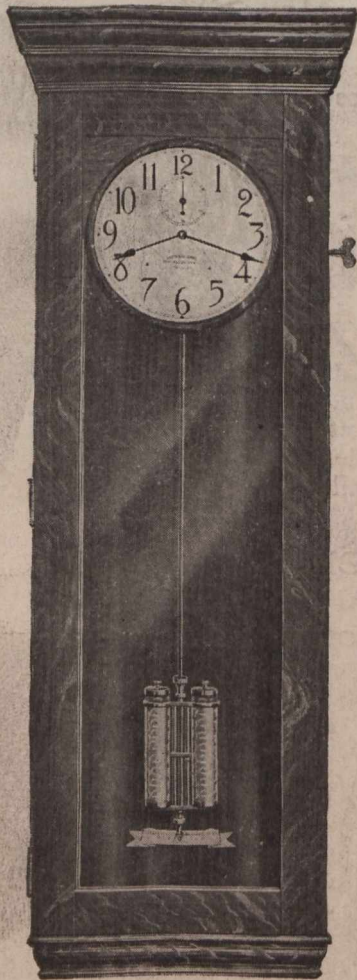
CANADIAN MINING JOURNAL

Vol. XLI

Gardenvale, P. Q., October 29, 1920.

No. 43.

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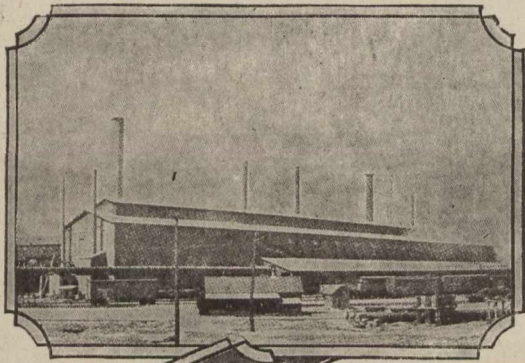
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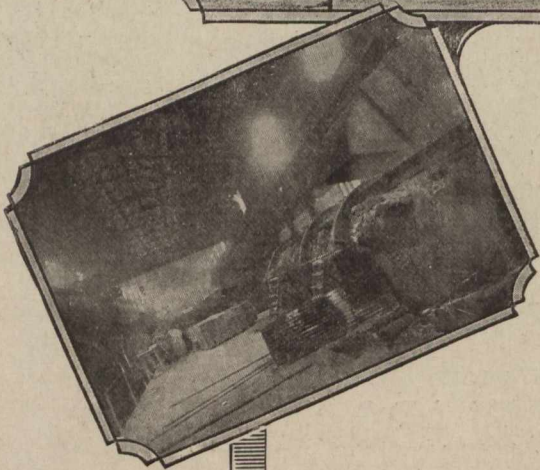
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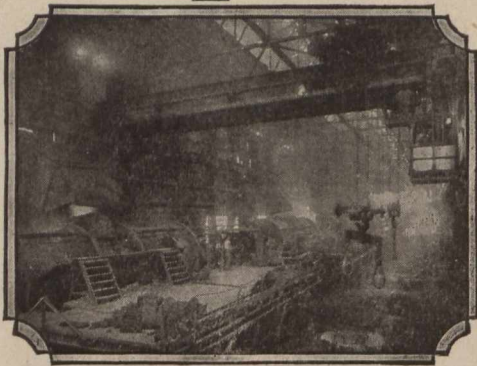
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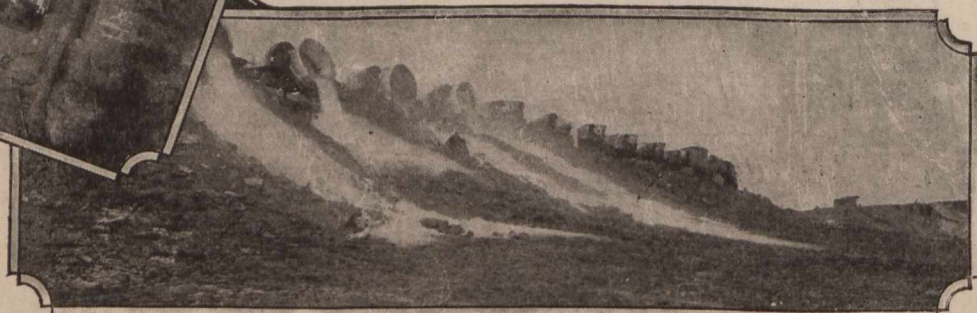
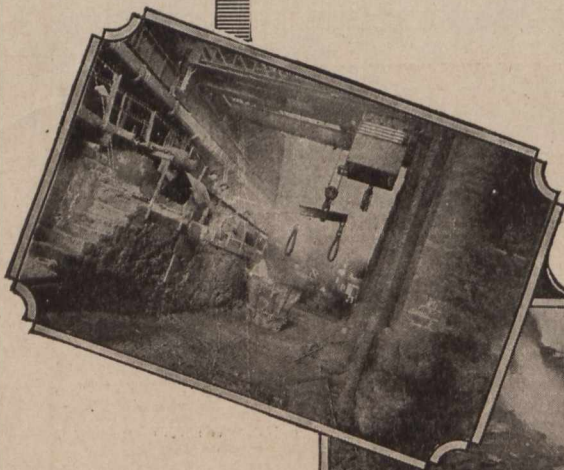
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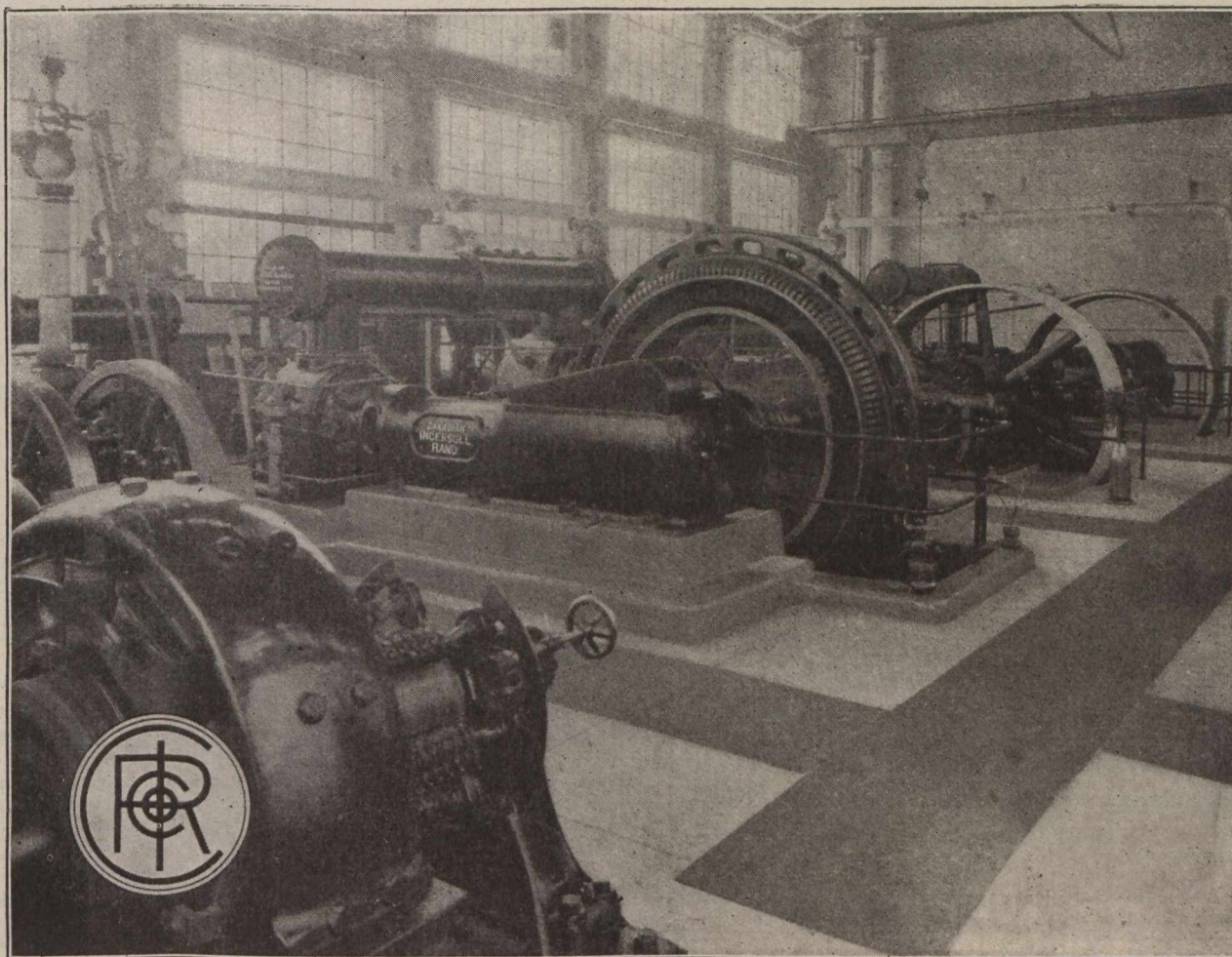
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Recent Publications

Results of forty-one Steaming Tests conducted at the Fuel Testing Station, by John Blizard and E. S. Malloch.

The Copper Smelting Industry of Canada. Report on, by A. W. G. Wilson, Ph.D.

Building and Ornamental Stones of Canada (British Columbia). Vol. V., by W. A. Parks, Ph.D.

Peat, Lignite and Coal; their value as fuels for the production of gas and power in the by-product, recovery producer. Report on, by B. F. Haanel, B.Sc.

Annual Mineral Production Reports, by J. McLeish, B.A.

The Coal-fields and Coal Industry of Eastern Canada, by F. W. Gray.

The Value of Peat Fuel for the Generation of Steam, by J. Blizard, B.Sc.

Analyses of Canadian Fuels. Parts I to V, by E. Stansfield, M.Sc., and J. H. H. Nicolls, M.Sc.

Graphite, by H. S. Spence.

Summary Report of the Mines Branch, 1918.

The Helium Sources of the British Empire, by D. J. McLennan and others.

The Mines Branch maintains the following laboratories in which investigations are made with a view to assisting in the development of the general mining industries of Canada:—

Fuel Testing Laboratory.—Testing value of Canadian fuels for steam raising and production of power gas; analyses, and other chemical and physical examinations of solid, liquid and gaseous fuels are also made.

Ore-Dressing Laboratory.—Testing of Canadian ores and minerals, to ascertain most economical methods of treatment.

Chemical Laboratory.—Analysing and assaying of all mineral substances and their manufactured products. Copies of schedules of fees, which are slightly in excess of those charged by private practitioners, may be had on application.

Ceramic Laboratory.—Equipment is such that complete physical tests on clays and shale of the Dominion can be made, to determine their value from an economic standpoint.

Structural Materials Laboratory.—Experimental work on sands, cements and limes is also undertaken.

Applications for reports and particulars relative to having investigations made in the several laboratories should be addressed to The Director, Mines Branch, Department of Mines, Ottawa.

GEOLOGICAL SURVEY

Recent Publications

Summary Report. The annual Summary Report of the Geological Survey is now printed in parts. Applicants should therefore, state what particular geologist's report is required, or what subjects they are interested in.

Memoir 105. Amisk-Athapapuskow Lake district, by E. L. Bruce.

Memoir 108. The Mackenzie River basin, by Charles Camsell and Wyatt Malcolm.

Memoir 110. Preliminary report on the economic geology of Hazelton district, British Columbia, by J. J. O'Neill.

Memoir 111. The Silurian geology and faunas of Ontario peninsula and Manitoulin and adjacent islands, by M. Y. Williams.

Memoir 113. Geology and mineral deposits on a part of Amherst township, Quebec, by M. E. Wilson.

Memoir 114. Road material surveys in the city and district of Montreal, Quebec, by Henri Gauthier.

Memoir 115. Geology of Matachewan district, Northern Ontario, by H. C. Cooke.

Memoir 116. Investigations in the gas and oil fields of Alberta, Saskatchewan and Manitoba, by D. B. Dowling, S. E. Slipper and F. H. McLearn.

Memoir 117. Geology and ore deposits of Ainsworth mining camp, British Columbia, by S. J. Schofield.

Museum Bulletin 30. Gabbros of East Sooke and Rocky Point, by H. C. Cooke.

Map 164A. St. John, New Brunswick. Topography.

Map 183A. Harricanaw-Turgeon basin; Abitibi, Timiskaming and Pontiac, Que. Geology.

Map 185A. Sandon (Slocan and Ainsworth Mining Divisions). Topography.

Map 1584. Blairmore, Alberta. Geology.

Map 1691. Buckingham, Hull and Labelle counties, Quebec. Geology.

Map 1705. Thetford-Black Lake area, Quebec. Topography.

Map 1707. New Glasgow, Pictou county, N.S. Topography.

Map 1712. Foothills of Southern Alberta, St. Mary river to Highwood river. Geology.

Map 1724. Sheep River, Alberta. Geology.

Map 1726. Athapapuskow Lake region. Geology.

Map 1739. Portions of Bristol, Onslow, McNab, Fitzroy and Torbolton townships, Quebec and Ontario. Geology.

Map 1742. Ainsworth, Kootenay district, B.C. Geology.

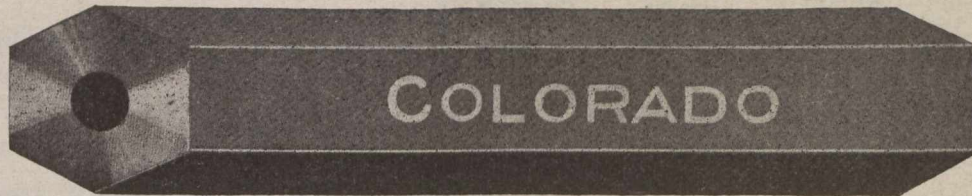
Map 1793. Matachewan, Timiskaming district, Ontario. Geology.

Applicants for publications not listed above should mention the precise area concerning which information is desired.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon.

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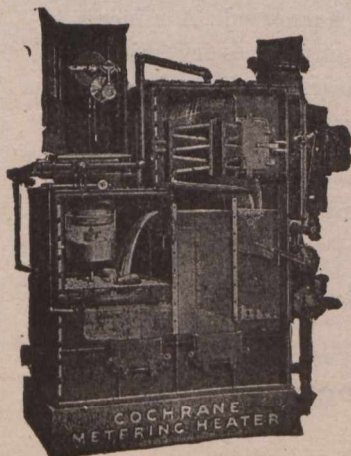
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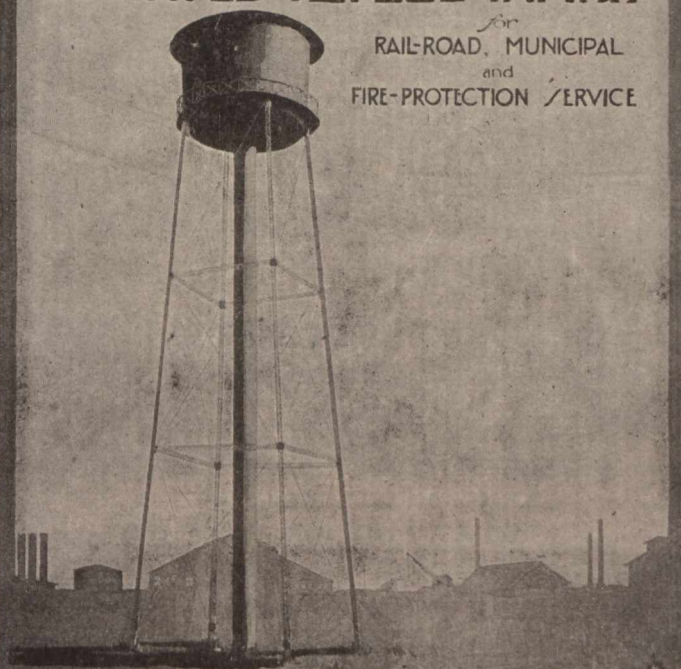
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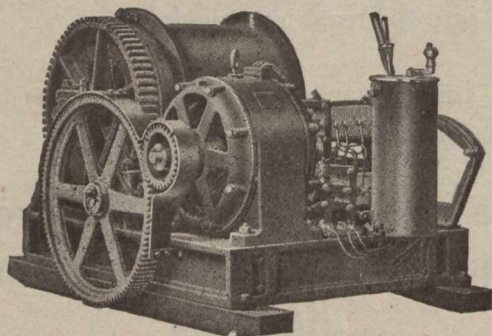
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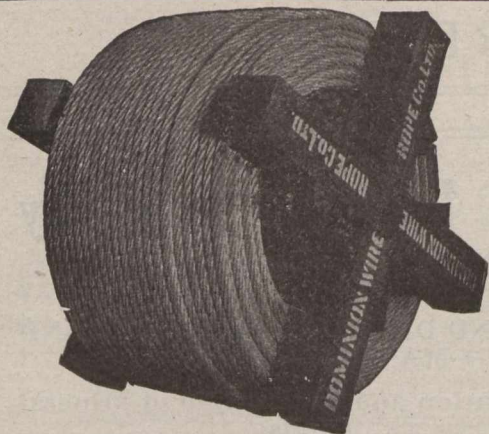
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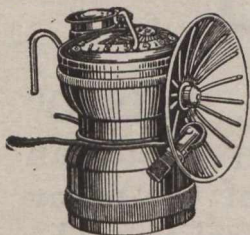
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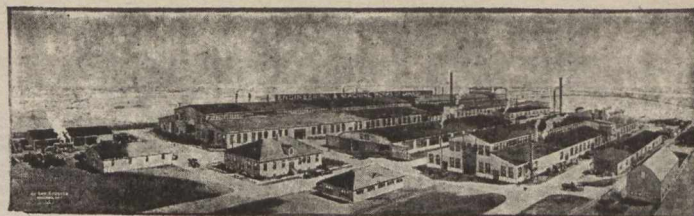
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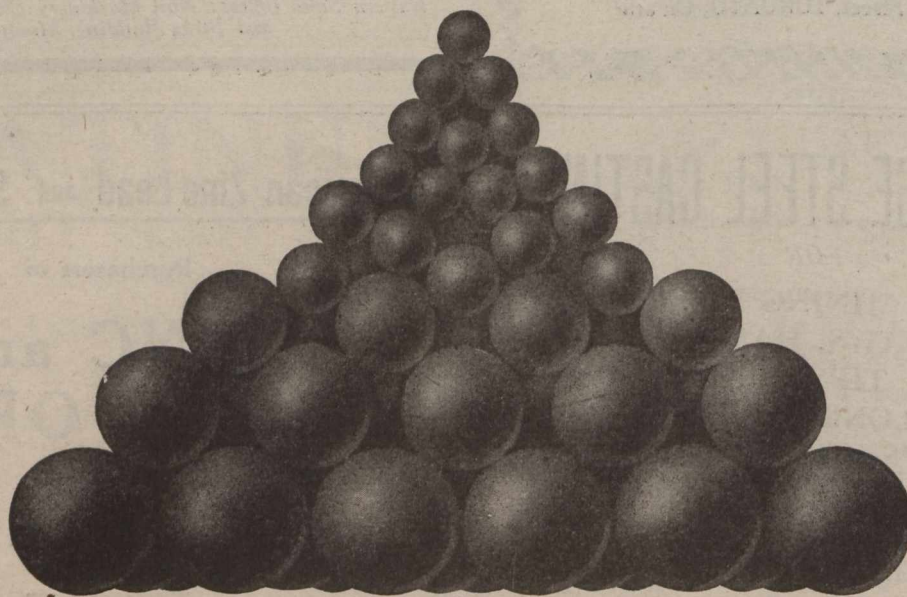
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GARDENVALE, P.Q., October 29, 1920

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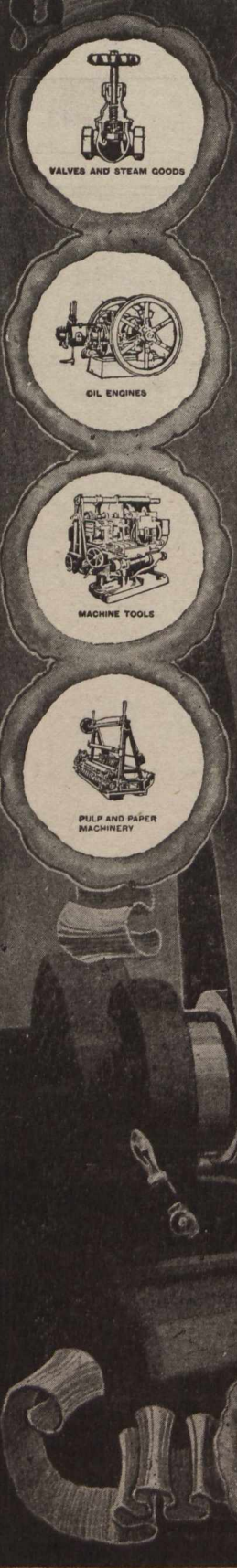
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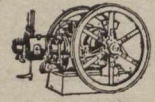
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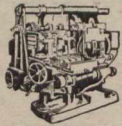
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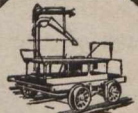
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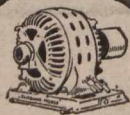
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EDITORIAL

THE SECOND WESTERN MEETING OF THE C. I. M. & M.

The Canadian Institute of Mining & Metallurgy is meeting in Winnipeg this week for the first time in annual general assembly, following the precedent of an annual western meeting inaugurated last year at the unqualifiedly successful gathering in Vancouver.

The choice of Winnipeg, hitherto the metropolis of an almost exclusively agricultural population, for a convention of mining men and metallurgists is significant of several things. As was the case in Toronto, so has been the course of events in Winnipeg, when the northern extension of a railway into the mineral-bearing pre-Cambrian rocks led to the discovery of valuable metals; and, although, with the possible exception of the Flin-Flon deposit, the mineral belt north of Le Pas has not yet been demonstrated to contain mineral wealth comparable with that of Northern Ontario, the conditions geologically are so similar as to suggest a possibility amounting to a probability that it may do so.

The Institute is to be the recipient of the official hospitality of the City of Winnipeg and of the Winnipeg Board of Trade, a compliment that the Institute will thoroughly appreciate.

The selection of domestic production of coal and iron as topics for discussion is recognition of their importance in Canada, which may be expressed in a sentence. The total value of the mineral output of Canada in 1919 was 173 million dollars. The value of importations of coal, petroleum, and iron and steel into Canada in that year was 272 million dollars. In mineral production alone, to say nothing of other items, this country is 100 million dollars per annum on the wrong side of the ledger.

OIL AT FORT NORMAN.

The finding of oil at Fort Norman is one instalment in a modern romance of prospecting. Fort Norman is as far north of Edmonton as that city is north of Denver, being only 400 miles upstream from the mouths of the Mackenzie River and just outside the Arctic Circle.

The difficulties of commercializing an oil-flow situated so remote from transportation routes, and so very far north, are great, but need justifies great effort and creates initiative. With an annual importation of 450 million barrels of petroleum into Canada, and a domestic yield of only 240,000 brls, Canada's necessity for a domestic source of petroleum is quite clear.

While such an oil-flow as is reported from Fort Norman would have been more immediately useful if found further south, yet the important thing is to know that it is contained within Canadian territory.

The President of the Imperial Oil Company has given out for publication a cautiously worded statement which very properly points out the uniquely difficult geographical location of the oil-strike, and expresses the opinion that while the strike is scientifically of much value, from a commercial point of view it is not of immediate value. The implication in Mr. Stillman's statement that the Imperial Oil Company is prepared to spend years in making the oil available for sale in the Canadian market, and that oil may be present in such volume as to justify the laying of a pipeline through the inhospitable wilderness, strike us as the most important portions of Mr. Stillman's remarks, as they disclose the intention of the Imperial Oil Company to prosecute an enterprise on which already much expenditure has been risked, and apparently not without good grounds.

The incident is the latest justification of the employment of the geologist, and confirms the deductions of the officers of the Canadian Geological Survey as to the possibilities of the Mackenzie River Basin, and especially Mr. D. B. Dowling's statement in our issue of April 9th last. Mr. Dowling noted the existence of Devonian beds that exhibit a very slight degree of folding in the Mackenzie Valley. These beds are divided by the Nahanni Mountains into two distinct basins, in one of which the Fort Norman well is situated. In both these basins, stated Mr. Dowling: "There seem to be great masses of oil-saturated shales, and porous dolomites, from which oil is expected to be obtained by drilling."

The Imperial Oil Company's oil-prospecting campaign is widely-extended and scientifically directed. In addition to the party that wintered on the Mackenzie River and the well drilled at Fort Norman, there is a drilling rig near the Great Slave Lake, and others in south-western and eastern Alberta and in south-western Saskatchewan. The mass of exact stratigraphical information which the drillings will enable to be compiled, and the utilisation of this by the trained economic geologists that are in the Imperial Oil Company's service will, it is hoped, be placed at the disposal of the Canadian Geological Survey by the Company, and will form a very welcome and a very substantial addition to the literature on this matter.

Some entirely novel developments in oil transportation seems likely to arise from any attempt to get this

northern oil to market, not the least of the difficulties to overcome being the handling of oil under low temperatures of long-sustained duration, and it looks as if once again the peculiarities of our geographical position will call out that adaptability for developing a special technique that, as in many other instances that could be named, gives Canadian technical workers a distinctive and honored position, and has in great measure created a characteristic national mentality that welcomes the hard jobs and is bored by the easy ones.

THE ASSOCIATION OF WORKMEN'S COMPENSATION BOARDS.

The Association of Workmen's Compensation Boards in Canada is becoming an important body. Originally planned to exchange information, statistics and other data interesting to men engaged in the administration of workmen's compensation in the various provinces of Canada, this association is rapidly developing into a national advisory council in matters pertaining to occupational accidents.

Co-ordination of statistics, comparison of the incidence of accidents, exchange of views of accident prevention, on rates of compensation, medical aid, pension funds, and many other matters that might be mentioned, provide useful and proper activities for conference by the representatives of provincial compensation boards, but, according to newspaper reports, the Association has extended its deliberations to the passing of resolutions advocating changes in workmen's compensation laws that amount to advice to the various provincial legislatures interested. Such resolutions are within the proper province of a meeting of citizens, but we think they are distinctly improper activities for an association of officials charged with the administration of workmen's compensation laws that differ in every province of Canada.

For example, a newspaper report states the opinion of the delegates to the Association at one session to have been that workmen's compensation should be extended to every workman, and not limited in its application to any set of industries. Another resolution passed was that accident prevention work should be placed under the compensation boards in each province, following the lead of some provinces that have already adopted this plan. There is much to be said for these opinions of the Association, and we would not wish to attack the merits of either proposal, but we conceive it to be distinctly outside the function of provincial officers, appointed to administer a statutory office, to advise the country at large as to what should be the trend of workmen's compensation legislation. As private members of an accountants' society, medical association, or bar society, such opinions might be properly advanced over the names of

their advocates, but they are distinctly not the business of an "association of Workmen's Compensation Boards in Canada."

HOOKWORM INFECTION IN A CHINESE MINE.

The "Mining Magazine" (London) contains a first instalment of a paper by Dr. F. C. Yen, Dean of the Hunan-Yale College of Medicine, China, describing the measures taken to control the hookworm disease (ankylostomiasis) at the Pingshiang Colliery in the province of Kiangsi, Central China. The colliery has been in operation twenty-two years, employs 12,000 men, and produces one million tons annually. The climatic conditions are tropical, hot and damp. The temperature in the mine does not fall below 78 to 80 degrees F. and the average humidity of the mine air is 97.7. The mine is wet and muddy, no toilet facilities are provided, the workers dispense with clothing, and the water in the mine drains is used for drinking and washing purposes. The conditions are therefore ideal for intensive and repeated infection, and are shockingly opposed to every western idea of sanitation.

In strange contradistinction to this state of affairs is the attempt that is being made by Dr. Yen, who judging from his scholastic titles is a medical man of eminence even to western ideas, to combat the all pervading infection of the hookworm larvae by sanitation, microscopical examination, and the resources of modern medical science. It is a picture that is typical of the social condition of a great nation, not so far removed by distance from Canada, that we can afford to be entirely indifferent to the phenomenon.

The debilitating effect of hookworm disease is pathetically told by the figures of production, for, even the primitive mining methods of the Chinese colliery do not explain a production of less than one-third of a ton per man per day.

Dr. Yen emphasises the necessity for control of the hookworm disease by pointing out that mining is an industry only just beginning in China, and that if the old mines could be freed from the infection, the new mines could be saved, and an inestimable boon would be conferred upon the industry.

It is impossible to remain unmoved by sympathy at the unvarnished—and in some details revolting tale—of a lone fight by a man of science against a disease that has its origin and residence in dirt and filth. Even the patient persistence of a learned Chinese doctor, equipped with all the armory of medical science against parasitic diseases, might quail before the herculean nature of his task. Neither self-sacrifice nor high romance can be said to have flown the earth in face of undertakings like this.

In Canada, probably the last thing we may fear in our mines is hookworm infection, and this is chiefly attributable to our climatic conditions, and the absence,

so far, of any deep hot mines which are at the same time moist mines. There is little doubt that if Canadian mines were possessed of the disposition to receive hookworm infection, such would have been reported, because infected workers have undoubtedly been employed, and, with some notable exceptions, such as the mines at Sudbury, no particular attention has been paid to underground sanitation. It has not been regarded as necessary, and from the point of the possibility of hookworm infection, it has probably been unnecessary. Nevertheless, reasonably sanitary, conditions are just as important underground as they are on the surface.

PROBLEM OF THE WORLD'S GOLD. RECEDING OUTPUT.

Below is reproduced a condensation of a speech delivered before the Brussels Conference by Mr. Henry Strakosch (South Africa), Managing Director of the Union Corporation, taken from the "Financier." Mr. Strakosch's conclusion that economy in the use of gold for monetary purposes is only possible through the restoration of sound monetary and credit policies, so largely destroyed by the financial straits occasioned by war expenditures, seems essentially sound. Artificial methods of gold stabilisation cannot restore the wastage of war, and as Mr. Strakosch lucidly phrases it, international credit can only be restored by the accumulation of savings resulting from increased production.

Currency and Exchange.

Dealing with the question of gold production generally, and especially as it has been affected by the war, Mr. Strakosch said the gold production of the world has steadily increased from 1893, when its value was 32.4 millions sterling, to 1915, when it reached the high-water mark of 96.4 millions. Since then it has rapidly declined, until in the year 1919 the value of the total world output was reduced to 72 millions sterling. He estimated that the yield for the current year would probably not exceed a value of 69 millions sterling, and he predicted that the world's gold output would show a further decline in 1921, and that from then onwards the output would more or less steadily recede.

The Uses of Gold.

As to the uses to which the gold output of the world has been put, he stated that from 1907 to 1913, when the output of gold on an average amounted to 94.7 millions sterling, the amount absorbed was to the extent of 22.6 millions (or 23.8 per cent.) for industrial purposes and for the arts in Europe and America, while the East, and especially India, has taken 17.7 millions sterling (or 18.7 per cent.) of the world's production, so that the world consumption of gold for purposes other than money has amounted to 40.5 millions (or 42.5 per cent.). The balance of 54.4 millions (or 57.5 per cent.) he assumed to have been devoted to monetary purposes.

The Diminution in Output.

"The rapidly diminishing world output of gold and the radical change which has taken place in the uses to which that metal is put at present, as compared with pre-war days, deserve special attention," he went on. The diminution in output, it was clear, had been brought about by increased cost of production, which was unaccompanied by a corresponding rise in the value of gold. As to the change in the uses of gold, the conclusion was irresistible that the low value of gold, in terms of commodities, had very materially extended the demand for that metal in the East and for industrial purposes. The increased prosperity of the country and the rise in silver and the fall in gold have had as their natural consequence an increased demand for the yellow metal, "for which these Eastern peoples are evidently prepared to pay more than the Western world is willing to give in order to secure it for monetary purposes." The cheapness of gold had also very naturally stimulated its demand for industrial purposes in the West. Hence the material curtailment of the supply of gold for monetary purposes.

"The prospect of a diminished world gold output very natu-

rally invited consideration of the possibility of measures which have for their object economy in the use of gold for monetary purposes, while the heavy depreciation in the currencies of many of the countries which formerly adhered to the gold standard suggests measures to prevent the value of gold from rising to its pre-war level.

Stabilising Present Value.

"To prevent the value of gold from rising means, in other words, to stop the price of commodities from falling in terms of gold. I, for my part, entertain great doubt as to the possibility of achieving this by international agreement. But if it were possible, what would be the consequences? The figures which I have given you, showing the material changes in the uses of gold since its price in the terms of commodities has fallen, clearly indicate the effect of any attempt to fix the value of gold at its present level. It would lead to a materially diminishing world output of gold, and, what is more, it would divert, as it has done during the last year, an increasing proportion to non-monetary uses. Is not then the conclusion forced upon one that it is neither practicable nor desirable to prevent the price of gold from rising in terms of commodities? I should add that a rise in the price of gold, while probably not increasing the world output of that metal, will certainly tend to retard its decline. But what is more important, it will have the effect—as in pre-war days—of preventing a predominant proportion of the gold output from being used for purposes other than money, so that we may, in these circumstances, again look forward to a very substantial proportion of the gold produced annually being devoted to monetary purposes.

"It is true that a rise in the value of gold—connoting as it does a prolonged process of deflation with falling commodity prices—would have detrimental effects on trade and enterprise, and consequently upon employment. But can it be expected that the maintenance of high commodity prices, by a more or less permanent depreciation of the monetary standards, will avert these pernicious effects? I, for my part, doubt it. The ravages of war have naturally very materially reduced the real purchasing power of the people, and that can only be gradually restored by savings resulting from increased production.

Economising Gold.

"A word about economising gold for monetary purposes. Great strides in that direction have been made in the decade or so prior to the war. The progress in that direction is undoubtedly due in a very large measure to the increasing mutual confidence in the methods of money and credit creation practised by the great commercial nations. This must surely be a sine qua non to any attempt at economising gold for the purpose. The money and credit policies imposed upon most of the nations—it is true by the hard necessity of war—are not conducive to restoring that confidence immediately. Only the putting into practice of a fixed determination to revert to sound methods can in time re-establish it, and thus pave the way to economies in the use of gold for monetary purposes."

OLIVER IRON MINING CO. SUED FOR ALLEGED INFRINGEMENT OF ORE WASHING PROCESS.

A \$40,000,000 suit by Capt. Alexander McDougall, of Duluth, against Oliver Iron Mining Co. for damages in connection with alleged infringement of an ore washer process is on trial in Federal Court here before Judge Booth of St. Paul. Plaintiff claims damages at rate of \$2 a ton on ore mined by defendant company between 1913 and November, 1918, and treated at its ore washing plant at Coleraine, Minn.

In evidence presented, attorneys for Capt. McDougall sought to prove that no genuine difference exists between the washer he invented and the type used by the iron company. Plaintiff alleges he submitted his invention to defendant company in 1908, and was informed that use could not be made of the stripping device, but the usefulness of the ore-washer was not denied.

Oliver Iron Mining Co. is contending that the McDougall patent is invalid, since a similar ore washer had long been in use. It denies that John G. Greenway, an engineer in its employ at the time, filed a patent for an ore washer after he had seen the McDougall invention and that the former's device was based on the latter.

The Case for a Bounty on Iron Ore Mining in Canada*

Iron Ore Mining, and an Adequately Developed Iron and Steel Industry, are Essential to Industrial Independence in Canada

The present status of iron ore mining in Canada is in anything but a satisfactory condition, considering the enormous bodies of iron ore within its borders.

The majority of the known deposits are what is known as low-grade ore, and require more or less treatment to bring them to merchantable grades, to meet furnace requirements.

The general classification of low-grade ores contain all non-merchantable ores. On the basis of iron content, they may be classified as follows:

1. Ores containing less than 40 p.c. of natural iron.
2. Ores containing between 40 p.c. and 50 p.c. natural iron that are used to some extent at the present time as concentrating ores, or are mixed with ores of high iron content, in order to increase the tonnage.
3. Ores containing over 50 p.c. natural iron that are not of the necessary physical structure to meet demands of furnace practice.

The necessary treatments take the form of magnetic separation, roasting, calcining, grinding and briquetting, and are collectively known as "beneficiation". All of these forms are well known to metallurgists, and have been brought to a high degree of perfection, especially on the iron ranges of Minnesota, where enormous sums have been expended in exhaustive experiments to demonstrate the commercial feasibility of magnetic separation, and other forms of beneficiation, with results that are so highly satisfactory that millions of dollars are being expended in the construction of plants for the exploitation of low-grade magnetites, averaging between 25 p.c. and 30 p.c. natural iron content.

The Mesabi Iron Company expended \$750,000 in testing magnetic separation, in an experimental plant, at Duluth, Minn. on ores of this character from the Eastern Mesabi range, and are now constructing an operating plant at Babbitt, Minn. the first unit of which, will entail an expenditure of \$3,000,000 and have a capacity of 3,000 to 4,000 tons per day. They are laying out a town on broad and permanent lines at this point, including all modern conveniences for a large force of operatives, metallurgical and office staffs, showing their confidence in the future outcome of their enterprise. This plant will be in operation this Autumn, and will enter the shipping class on the opening of navigation in 1921. It is fully expected that it will be a prominent factor in iron ore shipments from Lake Superior in the years to come.

This undertaking is being carried out by experienced metallurgists and iron ore mining operators, after thoroughly satisfying themselves that ores of the low iron-content mentioned above, can be mined, treated and placed on the market, in a form to meet the highest furnace requirements, at a profit, in competition with the high-grade ores of the Mesabi range. The efficiency of the machines developed in the Mesabi Iron Company is such, that the concentrates can be perfectly controlled, from the lowest grade, up to

72.4 p.c. iron content, thus enabling them to meet any furnace demand. The concentrates are produced in the form of a porous sinter, a most desirable form for furnace use.

The iron deposits of Northern Ontario are very similar in character to the low-grade ores of the Eastern Mesabi, and are largely amenable to the same form of treatment. Therefore, we should consider ourselves fortunate, that experience and responsible individuals, have successfully carried the beneficiation of low-grade magnetites through the experimental stage, and set the pace for what may be done with similar ores in Ontario.

Canada has immense quantities of beneficiable ores in the prospected parts, more particularly Northern Ontario, that are known to contain many millions of tons, at points traversed by the Canadian National Railway, the Canadian Pacific Railway, and the Algoma Central Railway. This will obviate a large initial expenditure for transportation facilities, which, ordinarily have to be overcome in the development of new iron fields.

Estimates, based upon diamond drilling, place the quantity of ore in certain Northern Ontario deposits at figures ranging from 100,000,000 tons downward. In other provinces of the Dominion, there are very large, but less definitely measured, possibilities in available ore.

In this connection, it may be pointed out that only about 50,000 feet of diamond drilling has been done on the Ontario ranges, as against some 10,000,000 feet on the Minnesota ranges. Drilling so far carried on, has resulted in disclosing large bodies of good merchantable ore, where only lean jaspilites showed on the surface. It may reasonably be assumed that further, and sustained drilling will locate other valuable deposits, when iron ore mining receives the encouragement that is its due.

Statements covering details of tonnage of the various Northern Ontario and other ranges, are included in an appendix hereto.

Our known deposits of iron ore thus represent supplies for years to come. The potentialities of the unprospected portions of the Dominion are enormous.

Iron ore mining in Canada is confined to Northern Ontario. The Algoma Steel Corporation, Ltd., operating the Magpie Mine, producing siderite ore, and the Moose Mountain Ltd. operating magnetite properties in the District of Sudbury, constitute the only activities in iron ore operations. Both these companies have extensive reserves of ore, proven by diamond drilling and milling development work. Both companies have carried beneficiation processes to such an extent, that they are convinced, that with reasonable Government aid, these low-grade ores can be profitably converted into marketable grades.

This has been arrived at, only after an extremely large expenditure, and is highly significant of what the possibilities are in beneficiating low-grade ores. It shows that under proper encouragement, Canada

* A memorandum presented to the Tariff Commission at Port Arthur, 16th October, 1920.

may produce sufficient domestic ore to displace the United States ore we are importing at the present time.

Canada's imports of iron ore has passed the 2,000,000 ton mark annually. Imports of iron and steel products for the year ending March 31st, 1920 reached the enormous figure of \$189,907,602. With an extensive railway mileage, years in arrears for betterments, and necessary upkeep, after six years of almost complete cessation of all classes of constructive development. With the necessity of catching up these arrears, and meeting the growing wants of our fast developing country, the imports of iron ore, and iron and steel products, may reasonably be expected to increase, unless active steps be taken to develop a domestic iron and steel industry, and displace the imported ores, and iron and steel products by our own resources.

The tonnage of domestic ore charged to furnaces in Canada, has fallen from about 300,000 tons in 1915, to less than 100,000 tons in 1919, or about 5 p.c. of the total tonnage smelted. Of the total of 653,137 tons of ore charged to 7 blast furnaces in Ontario, for the six months ending June 30th, 1920, only 58,387 tons were of domestic origin, the balance being imported from the United States. Exports of domestic ore are negligible.

What Iron Ore Mining Means to Canada.

It is quite obvious that the successful operation of iron mines means more than the employment of so much labour. It implies a maximum of activity in all lines of endeavour, a continuous flow of freight traffic, so necessary to our National Railways, the erection of steel works, by-product plants, wire, and wire nail plants, slag-cement works, and all classes of industries subsidiary to iron and steel works. It also implies the upbuilding of prosperous communities in the agricultural areas surrounding the iron ore deposits. The magnificent stretches of arable land in the great clay belt of Northern Ontario will be brought under cultivation, with markets provided by an iron mining industry. No class in the community will receive greater or more direct benefit than the farmer.

An iron and steel industry, on an adequate scale, will do more to solve the tariff problems of the former in Canada, than anything that could be done in his behalf, by way of tariff changes. We can never hope to have cheap agricultural machinery while we are obliged to import raw material in the vast quantities we are now doing.

If trade and commerce in Canada is to be put on a sound foundation, it is plain that this must be built up on a combination of the two great basic industries, of mining and agriculture.

Canada has done her part well in the upbuilding of the blast furnace industry, in granting \$17,000,000 in bounties during the period of 1896-1912. Without these furnaces, Canada would have been in a sorry plight during the Great War. While they have been, and are doing splendid service, they have been built up at the expense of the neglect of our own ores. This can be accounted for, largely from the fact of the easy accessibility of United States high-grade ores, and the further fact, that beneficiation had not been brought to the high state of perfection it is in today.

There are many reasons why Canada should take definite and immediate steps to develop an iron ore mining industry, some of which may be briefly summarized as follows:

1. The vital necessity of establishing an iron and steel industry on a stable basis, in order to secure

the industrial independence of Canada in the matter of iron ore.

2. The development of our vast resources in iron ore, as a means of defraying the tremendous financial obligations created by the war, the profitable development of our gigantic railway system, and the improvement of the water-ways of the Dominion.
3. The Canadian National Railway traverses four-fifths of the iron ore deposits of Northern Ontario, and would be immediately and directly benefited by the increased traffic developed by an iron mining industry. The product of the mine may be made the largest single source of railway traffic in Canada. In the United States, the mining industry contributes between 55 p.c. and 60 p.c. of all freight moved. Iron ore mining contributes a larger volume of freight traffic than any other branch of the mining industry.
4. To produce from its own ores the plates necessary for the construction of the ships of Canada's Merchant Marine, a branch of industry vital to the future prosperity of the Dominion, if a profitable and successful export trade is to be built up, and to enable Canada to take her old place in the world's shipping lists in the matter of registered tonnage, that she occupied at Confederation.
5. To furnish the traffic necessary to keep the ships of Canada's Merchant Marine profitably employed in exporting manufactured articles to world markets.
6. To solve the farmers' tariff problem, by the manufacture of cheaper agricultural machinery, more and more of which will be required as the west develops.
7. The development of Northern Ontario's iron ore resources would do more to wipe out the "East and West" in Canada, than anything else that could be undertaken. It would form a complete union of the two geographical sections.
8. It would materially decrease imports, right the balance of trade, and stabilize exchange.

While Ontario's iron ore resources have been more particularly referred to in this memorandum, these reasons apply with equal force in every Province of the Dominion.

NEEDS OF AN IRON ORE INDUSTRY.

As mentioned above, the iron ores of the Ontario ranges require some form of treatment to bring them to grades suitable for furnace use. The cost of this treatment varies with the different grades and qualities found in the Canadian ranges. To place Canadian iron ore operators on a parity with United States producers, some form of Government aid is vitally necessary to enable them to overcome the cost of the necessary beneficiation.

The Dominion Government has been memorialized by a larger number of Boards of Trade, Municipalities, Mining and other Industrial organizations, praying for the granting of a subsidy, to cover a period of fifteen years, of a fixed sum of seventy-five cents per ton, on all Canadian iron ore mined and marketed without restriction.

If Government aid to the extent of seventy-five cents per ton, be granted on all iron ore mined in Canada, it would immediately make possible the development of the immense deposits of low-grade magnetites, hema-

tites, and siderite ore of the Northern Ontario ranges. As iron-ore mining is now at such a low ebb in Canada, the amounts accruing to iron-ore operators under this system, would be very small for the first few years, as it would take some time to equip and develop ore lands, before the shipping stage could be reached. The amounts payable thereafter, depending as they do, on ore actually mined, beneficiated, shipped and sold, will simply be a measure of the growth of the industry. The larger they are, the larger will be the benefit to the country generally, as the subsidy would bring about disproportionately large returns in the stimulation of industrial activity.

Tangible assistance of seventy-five cents per ton on all Canadian iron ore mined and marketed without restriction, will unquestionably induce widespread activity in iron ore mining in Canada. The subsidy should be:

(a) In force for fifteen years.

(b) Paid monthly to mine operators.

(c) Reckoned (1) when the ore is milled or treated, on the long ton weights going into the milling or treating process; and (2) when not milled or treated, on the long ton shipping weights going to the furnace.

Necessity for Utilization of Our Low-Grade Ore.

The Province of Ontario is wholly dependant on the United States Lake Superior ranges for its supply of high-grade iron ore. The enormous tonnages of these ores that are being mined, shipped and smelted—between 55 and 60 million tons annually—naturally suggests the question: How long will these ranges hold out an available supply of high-grade ore for Canadian furnaces? The terrific drain on their resources must, within a measurable length of time, bring them to the point of depletion, insofar as the high-grade material is concerned. It would seem, therefore, that Ontario ores must, at no distant date, be called upon to supply the furnace requirements of this province. It is but the part of sound economy to be prepared for that eventuality. The only means of reaching that stage, where we will have an abundant supply of our own ores, is through Governmental assistants by way of a subsidy, to offset the costs of beneficiation.

When the utilization of our low-grade ores is undertaken, it must be on a large scale, with large plant units, capable of handling large tonnages daily. The plants must be built in the most substantial manner, equipped with machinery that will operate efficiently and continuously, under heavy loads, with a minimum of personal attention. This requires a large investment of capital, that can only be induced to take up the enterprise, with the Government assistance above referred to. These plants will require to have heavy and costly machinery installed, most of which, would have to be imported, on which, the Government should remit the duty, as a further measure of assistance.

To show that the references to the high-grade ore supplies of the United States Lake Superior ranges, have not been overdrawn, I beg to quote Prof. Edward W. Davis, of the Minnesota School of Mines Experimental Station, University of Minnesota, Minneapolis, Minn., in Bulletin No. 7, May 22nd, 1920 in "The Future of Lake Superior District as an Iron Ore Producer:"

"It is, of course, recognized by everyone, that at some future date all of the merchantable ore will have been removed from the district. This date is placed by various estimators at from 15 to 30 years hence. This statement is based on the assumption that the present rate of shipment will continue until

the end of the season of the last year. This, of course, cannot be the case. The history of any successful mining district shows that during the first few years of life, small tonnages of high-grade material are mined. As time passes, and a district is more largely exploited, the tonnage mined each year increases. As the tonnage increases the grade of the ore usually becomes lower. After a certain time, the yearly production reaches a maximum, and after the maximum is passed, the production gradually decreases. The rate of decrease is quite rapid at first, but absolute depletion may not occur for many years. The distribution of the Lake Superior ores among the various furnace companies shows that, while some companies have a sufficient supply of ore to last them 30 or 40 years, other companies have enough to last only 5 or 6 years. These companies are already looking about for new sources of ore supply, and if they are not found in the Lake Superior district, the companies will go elsewhere."

It may thus be seen that the present source of supply of high-grade ores for Ontario furnaces, have but a comparatively few years of expected life.

Electrical Development

Northern Ontario is in the fortunate position of possessing an abundance of water powers, that, on development, must play a considerable part, and be an important factor in the development and utilization of our iron ores.

The Nipigon River, in the District of Thunder Bay, is now under development by the Hydro Electric Power Commission, of Ontario. This River has a capacity of 200,000 H.P. of electric energy. The two first units of the present development will be ready for distribution at the Head of the Lakes, December 15th, 1920, followed by a further distribution up to 75,000 H.P. early in 1921.

When these powers are linked up with the modern methods and processes, for metallizing, and furnacing by electricity, already designed by a Canadian metallurgist, Mr. James W. Moffatt, of Toronto, we may reasonably look for the creation of a stable iron and steel industry, based on domestic ores, at an early date, provided the suggested aid be given by the Government.

These water powers are so located throughout Northern Ontario, as to be within easy access of all the iron ore ranges from the District of Rainy River on the west, to the most easterly deposits in the Districts of Algoma Sudbury.

APPENDIX.

Sources of Canadian Ore Supply.

ONTARIO.

1. Titaniferous magnetite ores of the Rainy River District, on Rainy Lake, where a large amount of diamond drilling has been done, disclosing large bodies of iron ore, high in iron content.

2. Steep Rock Lake, the most westerly extension of the main iron belt, quantities of high-grade hematite float led to the discovery, by drilling, of a body of soft ore some 70 feet in width. It is almost assured that the main body of the Lake is underlaid by this same deposit.

3. On the Atikokan range, west of Sabawe Lake, some 15,000,000 tons of magnetite has been proven by drilling operations, averaging 55 p.c. iron, 12 p.c. sulphur, and 10 p.c. phos. These are high sulphur ores, which, when roasted, make a most desirable furnace product.

4. East of Sabawe Lake, the Atikokan Mine, the only developed mine in the district, shows some 10,000,000 tons, averaging 55 p.c. iron, 2 p.c. sulphur, and 10 p.c. phos. This mine has produced 86,433 tons of ore, averaging 59.85 p.c. iron; 2 p.c. sulphur, and .11 p.c. phos.

5. On the Mattawin range, about 35 miles west of Port Arthur, and in Conmee township, in the same neighborhood, a large tonnage of lean ore is exposed averaging 35 p.c. or better. This deposit runs into many millions of ton, and can be quarried and handled by steam shovel. Tests made by the Dominion Testing Laboratories, Ottawa, show that by coarse crushing and jigging, a product running 50 p.c. iron can be obtained with a 2 to 1 concentration.

6. On the east shore of Lake Nepigon, known as the Nepigon range, there are numerous bodies running around 45 p.c. iron, or better. Drilling operations on this range located large bodies of good ore, where nothing but lean jaspilites showed on the surface.

7. At Little Long Lake, the eastern extension of the Nepigon range, there are extensive areas of iron outcrops. One body 30 feet in width, averages 42.67 p.c. iron, .05 p.c. phos. Another exposure 400 feet wide, averaged 42.35 p.c. iron, and another outcrop 20 feet in width averaged 49.78 p.c. iron.

8. The Loon Lake iron field is situated 26 miles east of Port Arthur. It is of a different geological age and character to the ores mentioned above, and is an undoubted extension of the Mesabi range in Minnesota. The beds are flat-lying, consisting of interbanded layers of high-grade hematite, and lean taconite, having a total thickness of 20 feet. The ore is easily separated by hand-sorting, yielding from one and three-quarters to two tons of merchantable ore, for every three tons of material handled. Less than one-third of this field has been tested by diamond drilling and pitting, yet 5,448,000 tons of ore, averaging between 48 p.c. and 55 p.c. iron, have been proved. Conservative estimates of the possible tonnage of this field are placed at 25,000,000 tons.

9. The siderite ores of the Michipicoten district in Algoma have been extensively drilled, and a tonnage estimated at over 2,000,000 tons have been proved at the Magpie Mine, and the New Helen Mine, by the Algoma Steel Corporation Ltd.

10. Over 100,000,000 tons of magnetite have been proved by diamond drilling at Moose Mountain in the District of Sudbury, by the Moose Mountain Mining Company. Estimates of the possible quantity of available ore go far beyond this figure.

11. Extensive deposits of magnetite are found on the Groundhog River, Rush Lake, and Wapoose Lake, on all of which diamond drilling has been done, disclosing large tonnages of ore.

QUEBEC.

1. The Bristol Mine is known to contain large deposits of magnetite, but has not been diamond drilled.

2. The Forsyth deposits of silicious magnetites have an estimated tonnage of 500,000 tons.

3. Extensive deposits of magnetic sands on the north shore of the St. Lawrence are estimated to contain 500,000 tons of magnetite.

4. The St. Charles deposits of titaniferous ores are estimated to contain 5,000,000 tons.

NOVA SCOTIA.

1. The Torbrook range with an estimated tonnage of 250,000 tons.

2. The Martin hematite property, with an estimated

tonnage of 115,000 tons.

3. There are extensive deposits in the Arisaig area, with no available records.

NEW BRUNSWICK.

1. The Bathurst deposits are a mixture of hematite and magnetite, and have an estimated tonnage of 7,000,000 tons.

2. Hematite deposits at Woodstock, and limonite deposits at Maugeville; no available estimates.

BRITISH COLUMBIA.

1. The Texada Island deposits of magnetite, having an estimated tonnage of 5,000,000 tons.

2. The Puget Sound deposits of magnetite, estimated at 4,500,000 tons.

3. The Glen iron mine in the Kamloops district, with an estimated tonnage of 8,000,000 tons of magnetite.

4. Further discoveries are being located by sustained prospecting and development work, in various sections of this Province, that hold out great promise on development.

MANITOBA.

1. Black Island in Lake Winnipeg, has large outcropping of hematite ore of good quality.

ALBERTA.

1. Recent investigations by the Geological Survey, show a large indicated tonnage of low-grade ores.

Note.—Graphs and tables showing production and importation of iron ore and iron and steel products in Canada were appended to the foregoing memorandum.

COPPER PRODUCTION IN SEPTEMBER.

Lessened Production, and Little Demand.

Production of smelter copper by the 19 leading mines of this country and South America amounted to 99,202,841 pounds in September, compared with 105,516,912 pounds in the preceding month, a decline of 6,314,071 pounds.

In the nine months to Sept. 30, however, the same mines report an output of 934,000,000 pounds, or approximately 76,000,000 pounds more than in the first nine months of last year.

It is fair to assume that the total copper production of all mines in North and South America is now running between 115,000,000 and 117,000,000 pounds a month, on the lowest estimate at the rate of nearly 1,400,000,000 pounds of smelter copper a year.

Notwithstanding present mining operations throughout the country are cut to 60% capacity, the resultant output is still far ahead of demand. Copper quotations last week broke through to new low levels, the metal being offered at 16 cents per pound, with virtually none taken. Copper consumers believe they are safe in buying on a hand to mouth basis; they feel that the American copper market cannot advance very rapidly when Europe is unable to purchase and domestic business is in a hesitant state.

It is estimated present surplus of refined saleable copper amounts to 600,000,000 pounds; approximately 400,000,000 pounds more is enroute to refineries and in process of reduction. There is, therefore, virtually 1,000,000,000 pounds of copper above ground today.

Formerly Europe took between 40% and 45% of our production. Since 1914 productive capacity has been greatly expanded to meet the abnormal demand engendered by the war, so while current operations are down to 60% of capacity, production is still virtually the same as in the years prior to 1914 and demand distinctly less.

BRITISH COAL OUTPUT & WAGES.**The Danger of Flat Rate Increases. Bad Effects of the Disappearance of the Differential between Day-wages and Contract Rates.**

(From "Iron & Coal Trades Review")

If the miners obtain another flat rate advance without any guarantee in regard to production, it is almost certain that the output per person employed will show a further decline. Flat rate increases are unsatisfactory; they assure exactly the same advance to workers of 18 years of age as in the case of married men, and the earnings of different classes of workers are disproportionate.

Assuming the owners' hands have not been tied in negotiations, they would appear to have missed an opportunity in attempting to equalise the "percentage" advances received by the various classes of workers employed in the industry, instead of suggesting a settlement on the basis of a wage advance for actual coal-face workers only, whose "net" earnings to-day, in comparison with pre-war days and other sections of mine workers, show a much smaller percentage increase. When it is considered that coal-face workers are entirely responsible for larger or smaller output, it is certainly in the interest of the coal trade in particular, and the country in general, that production should be stimulated, but any wage advance should be restricted to coal-face workers.

The percentage advances to coal-face workers varies with the bare getting price, but generally speaking it will be somewhere about 140 per cent.; against this, day workers in many cases have received advances of well over 200 per cent., whilst in the case of boys and youths it is even greater. On the face of things, therefore, it is obvious that the actual coal getters are entitled to something which should be given as a percentage increase on the bare getting price—not as a flat rate advance. By this means production might be improved.

The present flat rate advances paid to all workers over 18 years of age are:—War wage, 3s.; Sankey, 2s.; advance as from March 12 last, 2s. A total flat rate advance of 7s. per shift worked. After the commencement of the war, the first advance to workers engaged in the industry was given in May, 1915, in the shape of a war bonus of 15½ per cent. on total earnings. And it is very significant that each successive advance has been followed by a reduction in the output per person employed in the industry. The annual output per person employed in 1915 was 270 tons; 1916, 260; 1917, 247; 1918, 232; 1919, 197½. As from July 16, 1919, working hours were reduced from eight to seven per shift, it is necessary in order to get a true comparison to base the output as though eight hours had been worked the whole period. On this basis the output per person would have been approximately 211 tons. To be perfectly fair we must add to this a figure equivalent to the loss of something like five million tons as a result of the Yorkshire and other sectional strikes that took place during the year. If, therefore, we place the output per person for 1919 on an eight-hour shift basis at 216 tons, the fall in the production per person employed as between 1915-1916 was 10 tons; 1916-1917, 13 tons; 1917-1918, 15 tons; 1918-1919, 16 tons. A total reduction per person of 54 tons as between 1915 and 1919.

At the present time there are approximately 239,000 more persons employed in the industry than the average number during 1915, owing to the fact that in that year such large numbers joined H. M. Forces, so that on the face of things it is obviously a wrong method to fix the datum line on that of total outputs, because, provided a sufficiently large number of persons were employed, the output could be attained, in spite of a further reduction in output per person employed. Therefore, the datum line should be fixed on the output per total persons employed in the industry.

The output per person employed for the first half of this year was at the rate of 204.8 tons per annum for seven-hour shifts. This is equivalent to 234 tons (approximately) for eight-hour shifts, and shows a decided improvement by comparison with last year's tonnage. So far as it goes, this is satisfactory, but there is still a good deal of leeway to make up to bring the output per person employed into the parity with that for 1915.

STANDARD STOCK EXCHANGE QUOTATIONS.

	High.	Low	Last.
Silver			
Adanac Silver Mines, Ltd ..	23 ³ / ₈	21 ¹ / ₄	21 ¹ / ₄
Bailey	4	3 ¹ / ₈	4
Beaver Consolidated	39	36	38
Chambers-Ferland	4	4	4
Cobalt Provincial	47 ¹ / ₂	47 ¹ / ₂	47 ¹ / ₂
Coniagas	2.35	2.35	2.35
Crown Reserve	26	25 ¹ / ₂	26
Foster	11 ¹ / ₂	11 ¹ / ₂	11 ¹ / ₂
Hargraves7	.7	.7
La Rose	31 ¹ / ₂	30	30
Lorrain Con. M. Ltd	5	5	5
McKin.-Dar.-Savage	55	55	5
Mining Corp. of Can	1.74	1.70	1.74
Nipissing	9.50	9.05	9.25
Peterson Lake	12	11	11
Silver Leaf	3	2	2
Temiskaming	34 ¹ / ₄	34	34
Trethewey	28	24 ¹ / ₄	28
Gold.			
Dome Extension	40 ¹ / ₂	39 ¹ / ₂	40 ¹ / ₂
Dome Lake	4 ¹ / ₂	4 ¹ / ₂	4 ¹ / ₂
Dome Mines	12.85	12.30	12.50
Gold Reef	3 ¹ / ₂	3 ¹ / ₈	3 ¹ / ₂
Hollinger Cons	5.75	5.55	5.55
Hunton Kirkl'd G.M.	11	10 ¹ / ₂	11
Keora	16 ¹ / ₂	16	16 ¹ / ₂
Kirkland Lake	45	45	45
Lake Shore M. Ltd	1.05	1.03	1.05
McIntyre	2.02	1.98	1.99
Moneta	10	9	10
Porcupine Crown	23	23	23
Porc. Gold ... EX.R	1	1	1
Porcupine Tisdale	1	1	1
Porcupine V.N.T.	25	25	25
Preston East Dome	21 ¹ / ₂	21 ¹ / ₂	21 ¹ / ₂
Schumacher	22	22	22
Teck-Hughes	6	5	6
Thompson Krist	7 ¹ / ₂	7 ¹ / ₄	7 ¹ / ₄
West Dome	6	6	6
West Tree Mines Ltd	4 ⁵ / ₈	4 ⁵ / ₈	4 ³ / ₈
Wasapika Gold M. Ltd	9 ³ / ₄	9	9 ¹ / ₂
Miscellaneous.			
Vacuum G.	27 ³ / ₄	26 ¹ / ₂	26 ¹ / ₂

F. H. SEXTON**Director of Technical Education in Nova Scotia.**

(From the Bulletin of C. I. M. & M.)

Professor Sexton was born in New Boston, N.H., on June 9th, 1879, and his early education was obtained in the public schools at Billerica, Mass., and the English High School, Cambridge, Mass. From the latter he entered the Massachusetts Institute of Technology, taking the mining engineering course and graduating in 1901 with the degree of B.Sc. For a short period after graduation he was engaged as assayer and chemist with the Carmichael Reduction Company of Boston and then acted as instructor in metallurgy at his *alma mater* for about eight months. For about two years following he was engaged as research metallur-

sequence this matter was brought to the serious consideration of the Military Hospitals Commission. He provincial premiers and representatives in Ottawa in September, 1915, and placed the matter of industrial retaining before them with the result that the Commission was charged with the duty of actively proceeding with this important task. In March, 1916, he was asked to assist in the work of training the maimed and disabled soldiers for new occupations and was appointed a delegate from Nova Scotia to the conference of pointed to the position of Vocational Officer for Quebec and the Maritime Provinces. For four and a half years Professor Sexton has given his best efforts to this work in pleasant association with other prominent members of the Institute such as Mr. W. E. Segsworth and Professor H. E. T. Haultain. This work is now



PROFESSOR F. H. SEXTON, D.Sc., LL.D.

gist in the research laboratories of the General Electric Company, Schenectady, and left to take up the position of assistant professor of mining and metallurgy at Dalhousie University, Halifax, N.S.

When Nova Scotia led the other provinces of the Dominion in establishing a comprehensive system of technical education in 1907, Professor Sexton was appointed Director of Technical Education and President of the Nova Scotia Technical College, Halifax, which position he has held to the present time.

During the summer of 1915, he prepared memoranda on the vocational rehabilitation of war cripples for Sir Robert Borden and Sir George Foster, and in con-

being finished under the Department of Soldiers' Civil Re-establishment and none can deny that Canada's efforts in this direction are as noteworthy as her record in the field.

Professor Sexton was honoured with the degree of D.Sc. from Acadia University in 1918, and LL.D. from Dalhousie University in 1919. He has always taken an active interest in social service, civic improvement and education of all kinds, sorts and description. His chief diversions are angling and gardening and his pet aversions snakes and Bolsheviks.

For five years Professor Sexton was a member of Council of the Mining Society of Nova Scotia and Pre-

sident of the Society for two years. He joined the Institute in 1914 and was first elected to the Council for the two-year term 1917-1918. He was re-elected last spring as one of the Councillors for Nova Scotia and is also serving at present on the Council of the Mining Society of Nova Scotia.

He is a member of the advisory committee on mining and metallurgy to the Honorary Advisory Council for Scientific and Industrial Research, member of the Council of the Association of Professional Engineers of Nova Scotia, District Governor of Rotary Clubs for the Maritime Provinces, member of the Nova Scotia Institute of Science, of the National Society for Testing Materials and of numerous other educational and public organizations.

Northern Ontario Letter

THE SILVER MINES.

The Cobalt Field.

Operators in the Cobalt silver area have announced that beginning with November 1st, they are prepared to pay their men a flat wage equal to the former wage plus the daily bonus on the high price of silver. This announcement came as a surprise, owing to the fact that silver quotations have declined steadily during the past six months.

The decision to include the bonus of \$1.25 daily as of silver commanding \$1.20 an ounce, will make the flat wage higher than ever before in Cobalt's history. It will add about \$2,000 daily to the pay-roll or at the rate of about \$750,000 annually, as compared with what it would have been had the companies decided to discontinue the bonus and maintain the former base wage.

On November 1st the Coniagas will disburse a dividend of 2½ p.c., which will call for the distribution of \$100,000. This brings the total for the year up to \$500,000 and makes a grand total of \$10,040,000 since the mine was first opened. The company will close its fiscal year at the end of this week, and is understood to have had another successful year.

Some alarm was felt during the past week when silver quotations declined to a low of 76¼ cents per ounce. This quotation was about on a par with the cost of producing silver at some of the smaller mines, and left net profit to come only from the premium received on New York funds for which the silver is paid. Leading mines like the Nipissing, O'Brien, Kerr Lake and Coniagas were not threatened, but such properties as the La Rose, Crown Reserve, Peterson Lake, and even the McKinley-Darragh were obliged to do some close figuring. At the McKinley-Darragh, with production running at the rate of a little over 50,000 ounces monthly, the cost of producing the silver is understood to be not far under 80 cents an ounce. It may be seen, therefore, that at such properties the slump in silver quotations constituted just cause for alarm. At the time of writing, the price of the metal has strengthened several points, so that with the 10 p.c. premium, the margin of profit at such mines as the McKinley-Darragh is brought up to a very substantial amount.

The annual statement of the Temiskaming and Hudson Bay Mines shows an output of income of \$102,688 for the fiscal year ending with August. Expenditure during the period amounted to \$99,000, leaving a net profit of only \$3,688. Ore reserves are estimated to

contain 30,800 ounces of silver in the dumps, exclusive of the small areas underground which may yield limited quantities. The report refers optimistically to the company's holdings at Kirkland Lake and Gowganda, and points to these properties as valuable assets. As regards the Dome Lake which has been extensively backed by the T. & H. B., nothing definite has been decided upon as to future plans.

In view of the small profit realized on the Hudson Bay Mines, a good deal of strength is added to the reports that this property may be absorbed either by the Coniagas or by the Mining Corporation. In fact, it is intimated in usually well informed circles that the Mining Corporation is even now negotiating for a lease on the old mine.

The tailings pile on the Penn-Canadian mine has been optioned to the brokerage firm of F. C. Sutherland, Toronto. The Penn-Canadian has remained idle since the labor strike of last year, although a fair tonnage of medium grade ore still remains in the mine. No announcement has been made as to whether the Sutherland interests intend to re-treat the tailings pile or endeavor to arrange a sale to other interests.

At a depth of about 100 feet on the Ruby Silver mine, in the south-eastern part of the township of Bucke, a narrow streak of high grade ore has been encountered. Leaf silver also appears in the wall rock, and at the present point of operations shows commercial values over a width of close to three feet. The property is being operated under lease to Cobalt and Haileybury business men.

The Gowganda and Elk Lake Areas.

Another small shipment of ore has been made from the Castle property at Gowganda. About ten tons of high grade material came out recently. It is generally understood that current output is being maintained at a rate that covers the cost of operations, and that in the meantime, much necessary exploration and development work is being carried out. Latest advice would tend to show that the cross-cut at the 86-ft level has encountered the vein and with high values occurring at this point.

Unofficial advice just obtained conveys the information that the Miller Lake-O'Brien has encountered another high grade ore shoot. Whether or not this is in a new vein or on one formerly worked has not been ascertained.

As a result of favorable developments on the Miller Lake-O'Brien and the Castle, as well as general favorable conditions in the district, mining interests in this area have become more enthusiastic than usual, and a busy winter is anticipated.

Mr. Miller, Provincial Geologist for Ontario, together with Thos. W. Gibson, Deputy Minister of Mines, concluded their visit to this area last week.

The small mining plant on the Regent property near Elk Lake will soon be ready for operations, and sinking is to commence just as soon as steam can be turned on.

It is also learned that an endeavor is being made to raise finances to re-open the old Moose Horn property.

A shipment of about five tons of high-grade ore has been made from the Cane Silver Mines, a property situated south of Kenabeek, P.O., on the Elk Lake branch of the T. & N. O. Ry. The ore is said to contain from 500 to 1,000 ounces of silver to the ton, and was gathered by open-cutting a number of veins along the surface. It has now been arranged to commence sinking operations, and two shafts are to be put down

on two of the more promising veins.

During the week ended Oct. 22nd, four Cobalt companies shipped an aggregate of eight cars containing 653,339 pounds of ore. The Mining Corporation headed the list with four cars, as shown in the following summary :

Shipper	Cars	Pds.
Mining Corporation	4	283,230
Nipissing	2	194,815
Temiskaming	1	87,979
La Rose	1	87,315
Totals	8	653,339

During the corresponding period, bullion shipments were largely withheld owing to the slump in the price of silver. The Mining Corporation was the only bullion shipper, sending out 24 bars weighing 24,933.50 fine ounces.

Low water on the Montreal River has caused a shortage of power in Cobalt, as a consequence of which the mines of the district have been obliged to temporarily curtail work to some extent. Fall rains are considerably overdue, and relief is expected daily. In the meantime, the mines have mutually arranged to work alternately so as to share equally in the loss of time incurred.

THE GOLD MINES.

The Porcupine District.

The outlook for the gold mining industry as found in the Porcupine gold area is steadily improving. One of the most interesting and hopeful developments in the labor supply is now taking place, as found in the information that a large number of miners are already on the Atlantic, coming from the British Isles to work in the gold mines of the Porcupine field. It is learned to-day that 130 men are now in course of passage over the Atlantic and will be added to the strength of the force engaged at the Dome Mines. Another group of about equal number are to follow shortly. This information seems to suggest that the Dome has solved the problem of labor shortage and that by the end of the year this mine may be on a fair way to operate at full blast. In preparation for the improved situation, it is also learned the company has placed orders for additional mechanical equipment among which is included more than two dozen extra machines for underground work. As a consequence of all this, the general outlook has greatly improved.

It is reported that the Hollinger and McIntyre are planning to import about five hundred men from Wales but this report so far lacks official confirmation and is for that reason not emphasized in a manner equal to the more authentic advice regarding the Dome.

Mr. H. C. Hudson, superintendent of the Ontario Employment Bureau, Toronto, has stated some thirty mines in Northern Ontario gold and silver areas are prepared to take on an extra 1,850 men almost immediately, while an additional 500 could soon be absorbed. Wages are high and steady employment offered, and Mr. Hudson has issued a statement urging men to not overlook this opportunity to obtain steady work.

On November 3rd, the Hollinger Consolidated will disburse a 1 p.c. dividend, amounting to \$246,000. This is the seventh disbursement so far this year or a total of \$1,722,000. In addition to this, the company is expected to follow out its usual policy of paying two dividends during December, in which case the total for the year may be brought up to 9 p.c. or a total of \$2,218,000 for the period.

The McIntyre-Porcupine is the center of increased attention owing to the great probability of ore reserves being added to at a rapid rate as a result of the aggressive development of the new ore body found below the 1000-ft. level, North of vein No. 5. This new orebody is believed to be the easterly continuation of Hollinger's No. 84 which is at present the largest individual deposit in evidence on the Hollinger.

Announcement is made that negotiations are under way in England, with the object in view of disposing of the Davidson Consolidated to English interests. The company is capitalized at 5,000,000 shares, a majority of which is understood to already be under option to the English interests mentioned.

The Kirkland Lake District.

A meeting of the shareholders of the Hunton-Kirkland is being held to-day at which arrangements are to be made to proceed with increasing the capitalization from 1,250,000 to 2,500,000 shares. This added million treasury shares will be used as a means of financing future work.

The newly incorporated Kirkland Lake Proprietary, 1919, Ltd., is appealing to the shareholders of the Ontario Tough-Oakes Company to transfer their shares on the basis of two of the old for one of the new. Announcement is made that this new company has completed the details of acquiring the assets and undertakings of the English Tough-Oakes, the Aladdin-Cobalt and the Sudbury Syndicate, and is now negotiating with a view toward taking over the assets and the undertakings of the Burnside, as well as the Ontario Tough-Oakes and the Sylvanite. These details are secured from an official source.

In regard to the Kirkland Lake Proprietary, 1919, the one point not clear in this country is the financial status of the concern and the plan of operation. No definite information seems to be available on this side of the Atlantic, a fact which has caused certain of the stockholders in the merging companies to hesitate about making transfer of their shares.

On the Kirkland Lake Gold Mines, Ltd., developments at depth continue quite favorable. At the 500-ft. level as well as at a depth of 900 feet, high gold values have been encountered during recent months. Frank L. Culver, president of the company, came north at the end of the past week and made the statement that the outlook is exceedingly good.

Nothing has been mentioned during recent weeks about the possibilities of a merger between the Teck-Hughes and the Orr Gold Mines with the Kirkland Lake. The proposal was regarded as doubtful from the beginning, owing to the complicated status of the Orr as well as the financial obligations of the Teck-Hughes to its bondholders, as well as the debts owed by the Kirkland Lake to the parent company the Beaver Consolidated.

A small shipment of ore has caused interest in La Santa Lucia property, formerly the Cartwright Gold fields, in the Painkiller Lake district east of Matheson. The ore was taken out of a narrow deposit. The property is not far from the Croesus mine which a few years ago yielded very rich ore, but which contained no great volume.

The feeling is getting abroad that the gold mining industry has reached a point where from this date forward steady improvement will be shown, and the next few months are expected to witness considerable growth.

British Columbia Letter

Hazelton, B. C.: The activity of the Kleanza Mining Company and of the Kitselas Mountain Copper Co. Ltd., the development being pushed steadily ahead by James Cronin, and the general interest being displayed in prospecting, the immediate future looks bright for the Omineca District, from a mining viewpoint.

For some years the deposits of Hudson's Bay Mountain have been receiving attention. On the north-eastern slope are the Schufer, Martin, Carroll and Hanson properties and on the southern slope are the Coronada, Victory, Mamie, White Swan and several other claims. On the recommendation of J. D. Gallo-way, resident mining engineer, the Provincial Government has this year made substantial expenditures in the improvement of the roads and trails in this region. The road from Smithers to the Coronation and other groups in the same locality, as well as the transportation avenues on the northeastern side of the mountain have been much improved. Consequently a section giving promise of noteworthy productivity has been made accessible and may be expected to develop shipping mines.

The Kleanza Company is at work on a vein on Kleanza Mountain and is driving a tunnel which, it is figured, will make it possible to put their property in the shipping list. This tunnel should connect several veins of good ore if the plans of the management are realized. A sample of gold-copper ore came from this group carrying 4.2 oz. gold and 15 per cent. copper.

On Bornite Mountain, three miles out of Usk, the Hazel Group of Claims is being developed with promise of a successful outcome to those who have invested in the enterprise. The ore is a chalcopryite and bornite, with a small quantity of grey copper. Specimens have been assayed with returns of 28 oz. silver, 24.4 per cent. copper, and 0.10 oz. gold. Tunnel operations are to be started on a vein about five feet wide of mixed high grade and milling ore. There is a large mineralized dyke in this section which has been cut by Emma Creek and through the action of this waterway the ore being opened up was discovered and located.

From the Peerless Claims of the same locality was taken a specimen which was awarded first prize at a recent northern British Columbia Exhibition for copper ore. It weighed over a hundred pounds and is estimated to contain over 50 per cent. copper. Epidote and hornblende from the matrix of the vein from which this was taken. It has been stripped for over 100 feet and several deep cuts made, the result being the uncovering of 26 inches of very high class ore, the remainder of a width of 7 feet being milling material. There are some one hundred tons on the dump for shipping and plans are being made for the resumption of operations next season on a large scale.

There is a force of fifteen men at work on the Kitselas Mountain Copper Company's property also situated close to Usk. North and south drifts respectively are being driven on No. 1 and No. 2 A veins and a foundation of concrete is being laid under the Mill and so extended as to provide for an addition when one is required. The concentrates coming from the chalcocite and bornite ore are high

grade, giving returns of 48 per cent. copper, 40 oz. silver, and 2.20 oz. gold.

It is reported from the same section that notable success has attended the development of the Silver Horde Group of Claims at the head of Chiminess Creek, native silver being found in grey copper ore. The occurrence is in bands from an inch to a foot in thickness in a ten-foot dyke of calcareous material, lying in porphyritic trachyte. Assays have given returns of 266 oz. silver and 17 per cent. copper.

The Cronin Mine of the Babine Range has been under development for some years, the work most recently engaging attention being the driving of a tunnel into the ore from a level considerable below the outcrop.

The objective was reached this season, the workings now being in a substantial body of ore of a good grade. James Cronin, the owner and manager, is a well-known British Columbia operator. He proposes carrying on next year with a view to the commencement of shipping and it is possible that the Government, if its engineer's report is favorable, will make an appropriation for the improvement of the road into the district.

Stewart, B.C.

The Algonic Development Company has decided that further development of the George Group of Mineral Claims, situated on the south side of Bear River, Portland Canal Mining Division, shall be postponed to next season. The Company considers this as one of its promising holdings in northern British Columbia. Discussing it in a report recently issued George Clothier, resident mining engineer, explains that the country rock is greenstone, locally called the "Bear River formation" after McConnell; that there are several veins on the property lying in an extensive mineralized zone of from 70 to 80 feet in width; and that this large mineralization occupies an altered, more or less silicified area in the greenstone, and in which iron sulphides are disseminated, accompanied in some places by chalcopryite. It is stated that combined chalcopryite and pyrites also occur in bunches. There is a tunnel in this ore-body 105 feet long which is practically barren, the surface over the tunnel showing very little mineralization. This zone, it is asserted, might develop a large tonnage of low-grade ore. About 600 feet east of the tunnel at an elevation of 4,000 feet is a strong cropping of three veins contained in a width of 50 feet. Little mineralization can be seen on the surface in the filling between these veins but it is very probable that they are all in the same ore-zone. The best ore in all three will aggregate 10 feet, averaging \$4 a ton in gold, 30 cents in silver, and 3 per cent. copper. The veins stand practically vertical and have been traced for considerable distance on the surface.

Progress of importance has been made in opening up the property of the Indian Mines Ltd., situated on the west side of Cascade Creek, between the Salmon river glacier and Cascade Creek, Portland Canal Mining Division. The claims are at an elevation of 2400 feet and fourteen miles from tidewater at Stewart. Development consists of three open-cuts on the croppings and two tunnels. The former expose a vein from 12 to 20 feet in width, which can be followed on the surface for about 2,000 feet. The vein is quartz and appears to follow a wide dioritic dyke

which intrudes the greenstone-schists. The minerals found in the quartz are galena, sphalerite, and pyrites, the respective values being in the order named. The first two open-cuts going up the hill show very little galena the values being about \$10 a ton in gold and silver. The upper or main open cut discloses the vein for a width of 20 feet of which from 5 to 8 feet is a high grade of galena while on the hanging wall are found values in galena and zinc and on the foot wall there are quartz and pyrites.

In describing the showings that have resulted from the driving of a tunnel for about 150 feet vertically below and for a little over 400 feet with the vein. Roy Clothier,, who has been in charge of the work this season, states that each of the ore-shoots exposed on the surface has been located. No. 1 shoot, it is said, shows considerable galena at this depth; No. 2 shoot is entirely quartz and pyrites and will yield chiefly gold values; No. 3, or the main shoot, was struck at about 400 feet in the tunnel and drifted on for 30 feet. The ore started from a seam on the footwall and has widened to 14 feet at the face, as exposed by two cross-cuts. Three sectional samples across the face averaged \$2.40 gold, 3.5 oz. silver, 10 per cent lead, and 16 per cent zinc. The hanging wall crosscut at the face is in heavy zinc ore. Further work in driving this drift is considered of importance at the footwall portion of the vein, carrying the galena, is widening.

A lower tunnel, 150 feet below No. 1, has been driven about 60 feet on the vein in which there is from 1 to 3 feet of ore on the hanging wall.

Alice Arm, B.C.

For some weeks there has been a force of about 200 men employed at the Dolly Varden Mine, Alice Arm. During the summer large shipments of ore have been made, development and construction work also being carried on. The railway from the Mine to the Alice Arm townsite will have to be closed down, it is expected in the winter. It is understood that some 65 men will be kept on the payroll for development in the mine during the closed season.

Progress is being made in the opening up of the Wolf Claims, which belong to the same company and lie close to the Dolly Varden. Diamond drilling has been underway with satisfactory results and tunnelling is to commence without delay. An hydro-electric plant is being installed on the Wolf property of sufficient capacity to furnish the power necessary for the entire enterprise.

The Esperanza Mine, of the same district, has a shipment of high grade silver ore on the dump awaiting shipment to the Tacoma Smelter.

The Moose and Silver Tip Extension also are giving promise of becoming producers.

Slocan, B.C.

The lost vein of the Evening Star Mine, situated near Slocan, is reported to have been located from the old tunnel. There are indications that the old property will be in the shipping class again before long.

Grand Forks, B.C.

A. M. Johnson, who is interested in the Molly Gibson Mine at Paulson, states that there are good prospects of the property being a regular shipper,

seven feet of high class ore having been uncovered in the old shaft. The intention is to sink to the tunnel which has been driven into the mountain a distance of 200 feet. The Molly Gibson recently shipped ore to the Trail Smelter from which excellent returns were obtained.

Marysville, B.C.

The Canadian Consolidated Mining and Smelting Co. is about to commence the construction of a concentrating mill on the old site of the Marysville Smelter. Preliminary work is in hand.

Cranbrook, B.C.

William Thomlinson, collector of ore samples for the Dominion Department of Mines, is engaged in assembling an exhibit of British Columbia ores for the Chemical and Metallurgical Exposition to be held in New York City. The co-operation of the B. C. Prospectors' Protective Association and the Boards of Trade of different provincial centres is being secured in the endeavor to make the display truly representative. Specimens about 12 inches square and from 3 to 8 inches in thickness are being asked for and it is announced that transportation will be free from points about the line of the C. P. R.

Vancouver, B.C.

An illuminating sidelight on the enterprise and the energy of the British Government in advancing the work of opening up regions at present very little developed, is furnished by Major General J. W. Stewart B. C., a Canadian contractor of national repute, who has just returned from England where he has been in touch with the Colonial Office regarding an important contract to be awarded for railroad construction on the Gold Coast, South Africa. The project involves the building of a railroad to the north extending into Togoland, formerly German territory, as well as the construction of a dock at Sekondi, the chief port of the territory. Besides the agricultural resources of the district which will be tapped at the completion of this work, General Stewart explains, will permit an iron property owned by British interests to increase its annual shipment of 20,000 tons to 200,000 tons. The ore is of an exceptionally fine grade.

While the coal strike in Alberta and Eastern British Columbia still was in force on October 15th last, the indications at that time were that conditions soon would be back to normal. Predictions were made that most of the mines of the Province of Alberta would be operating much as usual in a few days. The mines of the Crow's Nest Pass District continue to be idle. The situation in this field may be expected to improve as soon as it mends in the adjacent Province.

An interesting occurrence in Alberta during the past week has been the granting by the Courts on application of the Coal Mine Operators of Alberta of an injunction restraining the operation of the One Big Union in the Drumheller field. The Order was issued on two grounds, namely, that the striking O. B. U. miners did not ask for a board of arbitration under the Lemieux Act before striking, and that O. B. U. officials were inducing men to break a contract entered into as members of the United Mine Workers of America which has two years more to run.

The newly designed Carbon-Monoxide Detector, approved by the U. S. Bureau of Mines, has been adopted by Hon. Wm. Sloan, Minister of Mines, for use in the coal mines of British Columbia. He took this step as soon as the value of the tester was demonstrated and each of the Inspectors of Mines will be furnished with one to assist them in the discharge of their duties. Heretofore the only practical test of mine air for the detection of this deadly poison was the carrying of a canary or some small animal known to be very susceptible to its influence. By noting the behavior of the bird or animal it was possible to arrive at some conclusion as to the condition of the air. This test, at the best, however, was unsatisfactory. The perfection of this Tester, therefore, is a decided advance in the direction of making underground conditions in coal mines safe for the workers, especially as the instrument records carbon monoxide content as low as 0.05 per cent. The deadliness of carbon monoxide to the human is well-known but it may be stated that less than 0.5 per cent. in a mine atmosphere may cause death.

That negotiations are in progress between a syndicate representing the British Admiralty and the owners of the Ground Hog Coal Lands, northern British Columbia, for the purchase of the latter property by the former is an announcement that has been received with much interest in the Canadian West. The coal lands are situated about 150 miles from Hazelton, B.C., and the coal is claimed to be as of high a grade as that of Wales and Pennsylvania, and of unexcelled quality for steaming purposes. The property has been undeveloped because of the necessity of constructing a railway for some distance and at considerable expense. However, the owners have a charter which, of course, would be transferred in the event of a sale. It is known as the Naas & Skeena Rivers Ry., starting at a point near Nasoga Bay on Portland Inlet and running back 120 miles to the nearest coal lands. A deal in which the British Government was supposed to be interested was under consideration from 1912 to 1914, during which period examinations by capable engineers took place, but no conclusion was reached because of the outbreak of the war.

J. M. Savage, for some years General Manager with headquarters at Victoria, B.C., of the Canadian Collieries (D) Ltd., has been appointed Chairman of the Company's Executive, vice-president Henry S. Fleming, resigned. This announcement was made after a meeting in Eastern Canada of the directors at which it was decided to concentrate the executive management of the concern in British Columbia. Mr. Fleming's retirement comes somewhat as a surprise inasmuch as he was in the Province this Summer investigating the iron ore resources of the country in view of the possibility of the Company launching an iron and steel industry in the Canadian Northwest.

Coal production by the collieries of British Columbia for the month of September follows:

Crow's Nest Pass Field.

	Tons
Crow's Nest Pass Coal Co, Coal Creek	36,611
Crow's Nest Pass Coal Co., Michel	21,086
Corbin Coal & Coke Co.	15,381
	73,078

Nicola-Princeton Field.

Middlesboro Collieries, Middlesboro	7,445
Fleming Coal Co., Merritt	2,143
Coalmont Coal Co., Coalmont	1,141
Princeton Coal Co., Princeton	1,952
	12,681

Vancouver Island Field.

Canadian Western Fuel Co., Nanaimo	56,775
Canadian Collieries (D) Ltd., Comox	42,005
Canadian Collieries (D) Ltd., S. Wellington.	8,461
Canadian Collieries (D) Ltd., Extension	14,545
Pacific Coast Coal Mines Ltd. S. Wellington	7,088
Nanoose-Wellington Co., Nanoose Bay	5,456
Granby Cons. S. & P. Co., Cassidy	16,477
	150,807

Note:—Between the time of writing and mailing word has been received that the miners of the Crow's Nest Pass, B.C., have returned to work. This would indicate that colliery labor conditions in British Columbia and Alberta once more are settled and all disputes in process of satisfactory adjustment.

ORE STATEMENT.

Following is a statement of ore shipments over the T. & N. O. Ry., for the month ending Sept. 30th, as shown in the regular monthly report by Arthur A. Cole.

Silver Ore.

	Tons
Cobalt Proper.	
1. Beaver	30.00
2. Coniagas Mine	75.50
3. Dominion Reduction	40.00
4. Hudson Bay	31.32
5. LaRose	83.25
6. McKinley-Darragh	42.44
7. Mining Corporation	212.09
8. Nipissing	985.87
9. O'Brien	104.02
10. Temiskaming Mine	32.48
11. Temiskaming Testing Laboratories	30.00
	1,606.97

The above shipments were made to the following Companies:

Canada.

Deloro Smelting & Refining Co., Deloro Mar-mora	1,427.72
Coniagas Reduction Co., Thorold	62.50

United States.

American Smelting & Refining Co., Pueblo.	74.32
American Smelting & Refining Co., Perth Amboy	42.43
	1,606.97

Price of Silver.

Sept. 15th. Highest	95.000
Sept. 1st. Lowest	91.500
Average	93.675

CANADA COPPER CORPORATION COMMENCES OPERATIONS AT ALLENBY PLANT, B.C.

It is announced from New York that the Canada Copper Corporation started up its new plant at Allenby, British Columbia on October 18th. The plant was ready to commence work on July 1st 1919, but transportation facilities were delayed until recently.

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Richard Trevithick, His Life and Inventions*

By J. HARVEY TREVITHICK.

Richard Trevithick was born on April 13th, 1771, in the Cornish Parish of Illogan, about midway between Camborne and Redruth and not far from Dolcoath Mine, one of the oldest and deepest tin-mines in Cornwall, of which his father, Richard Trevithick, Senr., was the manager. The elder Trevithick was manager of several Cornish mines, as he came from a line well known in the annals of Cornish mining, and easily traceable back to the sixteenth century. He claimed kinship with the Vivians, a name as familiar almost as Cornish cream, and still farther back to the Llewellyns. At the time of his son's birth, the elder Trevithick was manager of Dolcoath Mine and mine agent for the Tehidy Estates. He is described as being a man of sound judgment, and, as a manager, was his own engineer.

At the age of 24 Richard Trevithick stood forward prominently as the leading competitor of the celebrated James Watt. Up to this time no one seems to have appreciated the advantages to be effected by the use of high-pressure steam. Trevithick, however, wrestled with this subject for a long time, and to him seems to be due with but very little doubt the honour of pointing out its great advantages. Watt, of course, was Trevithick's greatest opponent, being a strong advocate of low-pressure steam; indeed, he was so strongly opposed to the use of high-pressure steam that he tried to get a Bill passed by Parliament to stop Trevithick from making such engines on account of danger to the public. There seems, however, to have been only one recorded serious explosion, but Watt made most of this to strengthen his opinion. Watt and Trevithick were engaged in patent litigation for many years. Trevithick, nothing daunted, and still obsessed with the idea that high-pressure steam was the correct thing and the most economical in working, invented the single-flue or Cornish boiler, which was cylindrical in shape, and had a cylindrical flue inside. How rapidly Trevithick's appreciation of high-pressure steam developed is proved by the fact that in 1813 he supplied boilers 40 feet long and 5 feet in diameter to work at a pressure up to 100 pounds per square inch, a very remarkable fact in view of the manufacturing limitations in those days.

At the age of 26 Richard Trevithick was selected to fill the position of engineer to the chief Cornish mines. The first marked improvement that he made in this year (1797) was the plunger-pole pump, which was to take the place of the old wooden mine pumps that had barrels hooped with iron, with a packed bucket inside containing a valve. Much trouble was experienced with these pumps owing to sand-jamb. Trevithick's invention was the now well-known plunger-pump, with the plunger working through a stuffing box, but quite free from the casing. In the following year came the invention of his water-pressure engine the first of which was erected at Weald Druid Colliery. Its object was to make use of the energy that is available where there is a large supply of water with a considerable fall. Another instance is that of a water-engine erected at Trenelthick Wood in 1799. A third instance was his

Derbyshire water-engine, erected in 1803, which operated on a beam like a steam-engine.

In 1800 Trevithick had produced the first high-pressure expansion steam-condensing winding-engine at Cook's Kitchen Mine for raising ore from the lower workings. The cylinder was double-acting, and the stream-pressure 25 pounds above that of the atmosphere. This engine had a crank, which was introduced probably for the first time, to give motion to the shaft; and with its 19-inch cylinder and 5-foot stroke was a standard type of beam-engine for nearly a century.

The most important period of his career saw his invention and development of the locomotive. It was, of course, the invention of the high-pressure steam-engine that made the locomotive possible, for the huge bulk of the low-pressure cylinders and boilers and the larger quantity of water required for condensing purposes were quite prohibitive on wheels. His first model (made in 1797) consisted of a horizontal cylindrical boiler with a vertical steam-cylinder let into the top at one end; connecting-rods from a cross-beam communicated the motion through cranks to the road wheels. A fly-wheel was attached to carry the engine over its centre.

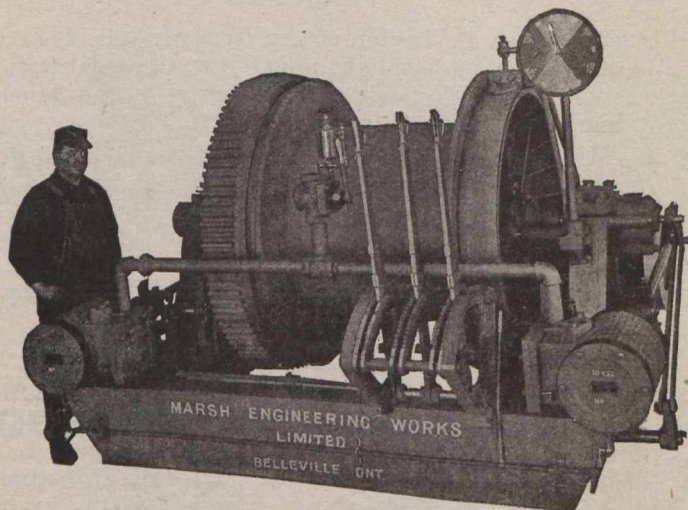
In 1801 Trevithick brought out his first practicable locomotive. It consisted of a sort of Cornish boiler, but with a return flue; the steam-cylinder was embedded vertically in the boiler at one end and the motion transmitted through head connecting-rods to cranks on the road wheels. The following are notable details:—A fusible plug in the flue to prevent damage from shortness of water in the boiler; bellows worked by the engine to create a draught; an exhaust in the chimney for the same purpose and a feed-water heater. In order to ascertain whether there would be sufficient adhesion between a smooth wheel and the road, he had experimented with a heavy carriage by causing it to go up a steep hill by turning its wheel round by hand.

Several trials were made, and finally it was upset, and while Trevithick and his friends were having dinner the machine caught fire and was destroyed. A result of these trials was an application for a patent, which was granted to Trevithick and Andrew Vivian on March 24th, 1802. The road-locomotive which Trevithick constructed in 1802 had two rear wheels about 9 or 10 feet in diameter and one front steering-wheel. The experience which Trevithick gained from the trial of this engine proved to him conclusively that a smoother road, made of iron, was necessary to enable the best running results to be obtained, and from this time onwards he devoted his attention to the form of engine which ultimately led to the modern railway-locomotive. In 1804, at Merthyr Tydvil, South Wales, Trevithick built and set to work his first tramway-locomotive, when he won a bet of £500 with Mr. Hill, of the Plymouth Iron Works, by running a train from Penydarran to Quaker's Yard, a distance of about 10 miles, at the rate of 4 miles per hour. It drew a load of 25 tons of material and carried several passengers. This engine had smooth driving wheels, but the rails were flanged in order to keep it on the track. In the latter part of 1804 Trevithick had another locomotive running at Newcastle-upon-Tyne. This engine had flanged wheels and ran on plain top rails—the universal practice to-day. All these locomotives were fitted with some form of blast-pipe, either under the fire or connected to the chimney.

From 1804 to 1808 Trevithick did little or nothing with the locomotive, but in the later year we find him

* From a paper read before the Institution of Mining Engineers, Manchester, September, 15th, 1920.

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We use the right materials to give the needed strength in every part. We then carefully inspect the workmanship in detail, and give the finished machine a thorough test before we allow it to leave our hands.

We have built up a reputation for a dependable Hoist. When you order a Marsh Hoist you are sure to get a good one. That is the only kind we make. May we demonstrate?

again busy on an improved engine, which he called "Catch me who can." In conjunction with this locomotive he constructed a circular railway in London, practically on the spot where Euston Station now stands. This locomotive weighed about 10 tons, and could obtain a speed of nearly 12 miles an hour. For several weeks it was exhibited and run on this circular railway. Trevithick, who by this time had exhausted all his means, was obliged to give up his endeavours of trying to convince the public of the enormous advantages to be gained by the use of the locomotive. After this mishap, he seems to have given up this branch of engineering.

During his locomotive period—from 1797 to 1808—Trevithick was not idle in other directions. In 1801 he erected an engine at Tredegar Iron Works for operating large rolls for puddling. This engine remained at work up till 1856. In 1803 he constructed what was undoubtedly the first steam-dredger. The dredger worked for some 10 years.

Other inventions which emanated from Trevithick's fertile brain included:

Ship's tanks of iron to replace the old wooden barrels for holding drinking-water, and also for ballasting purposes.

A paddle wheel for propulsion by steam.

The steam-winch about the year 1805.

It is on record that Trevithick had steam threshing-machines and grinding-machines, and even steam-ploughs at work in 1813.

In 1813 an event occurred which brought about a break in his career. A man of great influence in Lima, Peru—Don Francisco Uville—came to England to see whether he could obtain engines for pumping water in

the Peruvian mines. He placed orders with Trevithick for six engines complete with pumps. The cylinders of these engines were 24 inches in diameter by 6 feet stroke, and the pumps were 12 inches in diameter. The conditions were that the engines had to be despatched within four months. These conditions were fulfilled, and Don Francisco Uville persuaded Trevithicks to come with him to Peru to erect and start up his engines, with the result that he sailed for Lima on October 16th, 1816. He remained in South America for about ten years—till 1827. He was in Peru up to 1822, erecting engines, all of which worked with great success. In this year civil war broke out, which upset all the ambitions both of Don Uville and Trevithick. All the machinery was destroyed by the insurgents and thrown down the mine shafts, and Trevithick left Peru, sacrificing all his prospects of great wealth and apparently losing all that he possessed. From Peru he made his way to Costa Rica, where for the next five years he had a most venturesome time amongst the rich copper-mines there. In 1827 he returned to England. With all his genius, Trevithick never knew how to make money, or to keep it when he had made it.

For some time before his death, Trevithicks had been engaged at the works of John Hall, at Dartford, now the celebrated firm known as Messrs. J. and E. Hall, Limited. It was at these works that he and John Hall undoubtedly constructed and developed what is universally known as Hall's condenser. Trevithick was working at John Hall's works when the end came. Within two months of the design of the Reform Column, namely, on April 22nd, 1833, he had passed away at the Bull Inn at Dartford. He was penniless and without a relative by him in his last illness, and for the last offices

of kindness was indebted to some who were losers by his schemes. He was buried in the churchyard of St. Edmund King and Martyr in an unmarked grave. There is, however, inside the church, close to the pulpit, a handsome bronze tablet suitably inscribed "In memory of Richard Trevithick," which was placed there some years ago by Mr. Everard Hasketh, now managing director of Messrs. J. and E. Hall, Limited.

METAL QUOTATIONS.

Fair prices for Ingot Metals in Montreal, October 27th 1920. (In less than carload lots).

	Cents per lb.
Copper, electro	21
Copper casting	20½
Tin	50
Lead	8
¾ zinc	9
Aluminum	34
Antimony	8¼

TORONTO COAL PRICES.

Toronto, Oct. 27.—There is very little buying of coal in Toronto in anticipation of a further reduction in prices and the market is quiet. The bituminous situation is still described as being up in the air although it is expected that a couple of weeks' time will see conditions back towards normal. Hard coal is still quoted at from \$8 to \$16 gross tons at the mines, American funds. Mine run is slightly lower, the ruling quotation ranging from \$13 to \$14 f.o.b. Toronto Smokeless coal, also, shows a downward tendency, being quoted at from \$11.50 to \$13.

NIPISSING COMPANY OF COBALT PURCHASES MAGNETITE MINE IN NEW YORK STATE.

Nipissing Mines Co. has purchased Magnetite Mines Co., an iron property some 60 miles from New York City. The property contains, it is estimated, ore reserves of many millions of tons, and up to time of its shut-down, 30 years ago, constituted the largest working iron deposit east of the Mississippi. Both the New York Central and the New Haven could serve the new acquisition of Nipissing.

It is understood the purchase price, together with cost of erecting a plant, does not entail much over \$1,000,000. Nipissing has a surplus of between \$5,000,000 and \$6,000,000.

The ore runs about 37 per cent iron and concentra-

tes about two into one, with a resultant product averaging 60 per cent iron. It is believed this would find a ready market, but greater profits would probably result from a pig iron product. This would entail erection of blast furnaces.—Boston News Bureau.

PERSONAL.

Mr. Allen B. Taylor of the firm of J. G. Beatty & Co. left on the "Mauritania" for Great Britain in connection with business pertaining to the Murray-Mogridge Mining Company.

Mr. Samuel W. Cohen, Consulting Engineer of Montreal, sailed recently on the "Empress of France" and will be in Europe for two months on professional business.

Bureau of Canadian Information



THE Canadian Pacific Railway, through its Bureau of Canadian Information, will furnish you with the latest reliable information on every phase of industrial and agricultural devel-

opment in Canada. In the Reference Libraries maintained at Chicago, New York and Montreal is complete data on natural resources, climate, labor, transportation, business openings, etc., in Canada. Additional data is constantly being added.

No charge or obligation attaches to this service. Business organizations are invited to make use of it.

Canadian Pacific Railway
Department of Colonization and Development
 165 E. Ontario St. Chicago 335 Windsor Station Montreal 1270 Broadway New York

Nova Scotia Steel and Coal Co., Limited

Proprietors, Miners and Shippers of SYDNEY MINES BITUMINOUS COAL. Unexcelled Fuel for Steamships and Locomotives, Manufactories, Rolling Mills, Forges, Glass Works, Brick and Lime Burning, Coke, Gas Works, and for the Manufacture of Steel, Iron, Etc. COLLIERIES AT SYDNEY MINES, CAPE BRETON.

Manufacturers of Hammered and Rolled Steel for Mining Purposes

Pit Rails, T Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies. Blued Machinery Steel 3-8" to 1-4" Diameter, Steel Tub. Axles Cut to Length, Crow Bar Steel, Wedge Steel, Hammer Steel, Pick Steel, Draw Bar Steel, Forging of all kinds, Bright Compressed Shafting 5-8" to 5" true to 2/1000 part of an inch. A full stock of Mild Flat, Rivet Round and Angle Steels always on hand.

SPECIAL ATTENTION PAID TO MINERS' REQUIREMENTS. CORRESPONDENCE SOLICITED.

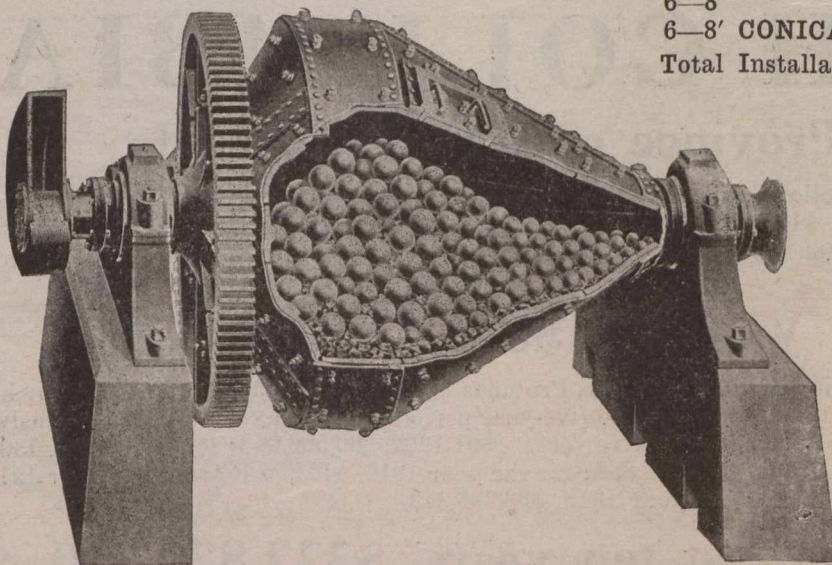
Steel Works and Head Office: **NEW GLASGOW, NOVA SCOTIA**



And Nevada Con. Takes Six More

Another "Crushing Victory" for Hardinge Mills is recorded by the fourth repeat order just received from the Nevada Consolidated Copper Company.

2-8'	Conical Ball Mills	December 1915
2-8'	" " "	July 1916
2-8'	" " "	August 1916
6-8'	" " "	June 1917
6-8'	CONICAL BALL MILLS	JUNE 1920
Total Installation — 18 Hardinge Conical Mills.		



The first repeat order was the result of a direct competitive test.

The last repeat order (just placed) is the result of another competitive test under different conditions.

It is the proven superiority of Hardinge Conical Mills—as demonstrated at the Nevada Consolidated and scores of other plants—that has made them the standard equipment for preliminary and fine grinding in plants all over the world.

Our "Grinding Data" leaflets give specific figures and information that will enable you to judge just what Hardinge Mills can do for you. We will be glad to send them.

**NIGHT AND DAY
THEY GRIND AWAY**

HARDINGE COMPANY

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ERITH, ENG.

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SPOKANE, WASH., OLD NATIONAL BANK BUILDING
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LONDON, ENGLAND, SALISBURY HOUSE

CABLE
ADDRESS
"HARDINGMIL
NEW YORK"



PROVINCE OF QUEBEC

MINES BRANCH

Department of Colonization, Mines and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is \$10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of \$10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of \$5 an acre for SUPERIOR METALS, and \$3 an acre for INFERIOR MINERALS

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

HONOURABLE J. E. PERRAULT,
MINISTER OF COLONIZATION, MINES AND FISHERIES, QUEBEC.

BRITISH COLUMBIA

The Mineral Province of Western Canada

Has produced Minerals valued as follows: Placer Gold, \$75,722,603; Lode Gold, \$100,272,431; Silver, \$50,432,304; Lead, \$43,821,106; Copper, \$153,680,965; Zinc, \$16,818,487; Coal and Coke, \$199,123,323; Building Stone, Brick, Cement, etc., \$29,991,757; Miscellaneous Minerals, \$786,918; making its mineral production to the end of 1919 show an

Aggregate Value of \$670,649,894

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1895, inclusive, \$94,547,241; for five years, 1896-1900, \$57,605,967; for five years, 1901-1905, \$96,509,968; for five years, 1906-1910, \$125,534,474; for five years, 1911-1915, \$142,072,603; for the year 1916, \$42,290,462; for the year 1917, \$37,010,392; for the year 1918, \$41,782,474; for the year 1919, \$33,296,313.

Production During last ten years, \$322,829,310

Lode-mining has only been in progress for about twenty-five years, and not 20 per cent. of the Province has been even prospected; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Province are more liberal and the fees lower than those of any other Province in the Dominion, or any Colony in the British Empire.

Mineral locations are granted to discoverers for nominal fees.

Absolute Titles are obtained by developing such properties, the security of which is guaranteed by Crown Grants.

Full information, together with Mining Reports and Maps, may be obtained gratis by addressing

THE HON. THE MINISTER OF MINES
VICTORIA, British Columbia.

The Canadian Miners' Buying Directory.

Acetylene Gas:

Canada Carbide Company, Ltd.
Canadian Fairbanks-Morse.
Prest-O-Lite Co. of Canada, Ltd.

A.C. Units:

MacGovern & Co.

Agitators:

The Dorr Co.

Air Hoists:

Canadian Ingersoll-Rand Co., Ltd.
Mussens, Limited.

Alloy and Carbon Tool Steel:

H. A. Drury Co., Ltd.
International High Speed Steel Co., Rockaway, N.J.

Alternators:

MacGovern & Co.

Spielman Agencies, Regd.

Aluminium:**Amalgamators:**

Northern Canada Supply Co.
Mine and Smelter Supply Co.
Wabi Iron Works.

Antimony:

Canada Metal Co.

Antimonial Lead:

Pennsylvania Smelting Co.

Arrester, Locomotive Spark:

Hendrick Manufacturing Co.

Arsenic White Lead:

Coniagas Reduction Co.

Assayers' and Chemists' Supplies:

Dominion Engineering & Inspection Co.
Lymans, Limited
Mine & Smelter Supply Co.
Pennsylvania Smelting Co.
Stanley, W. F. & Co., Ltd.

Ash Conveyors:

Canadian Link-Belt Company

Ashes Handling Machinery:

Canadian Mead-Morrison Co., Limited
Canadian Link-Belt Co., Ltd.

Assayers and Chemists:

Milton L. Hersey Co., Ltd.
Campbell & Deyell
Ledoux & Co.
Thos. Heys & Son
C. L. Constant Co.

Asbestos:

Everitt & Co.

Balls:

Canadian Foundries and Forgings, Ltd.
Canadian Steel Foundries, Ltd.
Hull Iron & Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works.
The Hardinge Conical Mill Co.

Ball Mills:

Hardinge Conical Mill Co.
Hull Iron & Steel Foundries, Ltd.
Mine and Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works.

Balances—Hessner:

Canadian Fairbanks-Morse Co., Ltd.
Mine and Smelter Supply Co.

Babbit Metals:

Canada Metal Co.
Canadian Fairbanks-Morse Co., Ltd.
Hoyt Metal Co.

Ball Mill Feeders:

Fraser & Chalmers of Canada, Ltd.
Hardinge Conical Mill Co.
Hull Iron & Steel Foundries, Ltd.

Ball Mill Linings:

Hardinge Conical Mill Co.

Hull Iron & Steel Foundries, Ltd.

Belting—Leather, Rubber and Cotton:

Canadian Fairbanks-Morse Co., Ltd.
Canadian Link-Belt Co., Ltd.
The Mine & Smelter Supply Co.
Northern Canada Supply Co.
Jones & Glasco.

Belting:

R. T. Gilman & Co.
Gutta Percha & Rubber, Ltd.

Belting—Silent Chain:

Canadian Link-Belt Co., Ltd.
Hans Renold of Canada, Limited, Montreal, Que.
Jones & Glasco (Regd.)

Belting (Transmission):

Goodyear Tire & Rubber Co.

Belting (Elevator):

Goodyear Tire & Rubber Co.

Belting (Conveyor):

Goodyear Tire & Rubber Co.
Gutta Percha & Rubber, Ltd.

Blasting Batteries and Supplies:

Canadian Ingersoll-Rand Co., Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
Canadian Explosives, Ltd.
Giant Powder Co. of Canada, Ltd.

Bluestone:

The Consolidated Mining & Smelting Co.

Blowers:

Canadian Fairbanks-Morse Co., Ltd.
MacGovern & Co., Inc.
Northern Canada Supply Co.
Fraser & Chalmers of Canada, Ltd.

Boilers:

Northern Canada Supply Co.
Canadian Ingersoll-Rand Co., Ltd.
Marsh Engineering Works
MacGovern & Co., Inc.
R. T. Gilman & Co.
Fraser & Chalmers of Canada, Ltd.
The John Inglis Company
Wabi Iron Works.

Blue Vitriol (Coniagas Red):

Canadian Fairbanks-Morse Co., Ltd.

Bortz and Carbons:

Diamond Drill Carbon Co.

Boxes, Cable Junction:

Standard Underground Cable Co. of Canada, Ltd.
Northern Electric Co., Ltd.

Brazilian Rough Diamonds:

Diamond Drill Carbon Co.

Brazilian Mica:

Diamond Drill Carbon Co.

Buggies, Mine Car (Steel)

Hendrick Manufacturing Co.

Brazilian Ballas:

Diamond Drill Carbon Co.

Brazilian Rock Crystal:

Diamond Drill Carbon Co.

Brazilian Tourmalines:

Diamond Drill Carbon Co.

Brazilian Aquamarines:

Diamond Drill Carbon Co.

Bridges—Man Trolley and Rope Operated—Material Handling:

Canadian Mead-Morrison Co., Limited

Bronze, Manganese, Perforated and Plain:

Hendrick Manufacturing Co.

Buckets:

Canadian Ingersoll-Rand Co., Ltd.
Canadian Mead-Morrison Co., Limited
The Electric Steel & Metals Co.
R. T. Gilman & Co.
Hendrick Manufacturing Co.
Canadian Link-Belt Co., Ltd.
Marsh Engineering Works
Mussens, Ltd.
MacKinnon Steel Co., Ltd.
Northern Canada Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Buckets, Elevator:

Canadian Link-Belt Co., Ltd.
Hendrick Mfg. Co.

Cable—Aerial and Underground:

Canada Wire & Cable Co.
Northern Canada Supply Co.
Standard Underground Cable Co. of Canada, Ltd.

Cableways:

Canadian Mead-Morrison Co., Limited
Fraser & Chalmers of Canada, Ltd.
Mussens, Ltd.
The Wabi Iron Works
R. T. Gilman & Co.

Cages:

Canadian Ingersoll-Rand Co., Ltd., Montreal, Que.
Northern Canada Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
The Mine & Smelter Supply Co.
Mussens, Ltd.
The Wabi Iron Works

C. X. L.

Blasting Supplies

The success of your blasting operations depend to a great extent on the quality of the materials you use.

To give satisfactory results, blasting materials of every descriptions must be up to the very highest standard in every respect.

C. X. L. blasting supplies are all up to this standard. They have won their popularity from their efficiency and the results consumers have with them.

C. X. L. Explosives have a known dependability. Every line assures the user entire satisfaction.

C. X. L. Supplies include:

Electric Blasting Cups	Safety Fuses
Electric Squibs	Cap Crimpers
Delay Electric Fuses	Thawing Cans
Blasting Mats	Blasting Caps
Tamping Bags	

"C. X. L." on your blasting supplies is your guide to the best.

Canadian Explosives Limited

Head Office, Montreal

Main Western Office, Vancouver



District Offices :

Halifax	Montreal
Toronto	Timmins
Ottawa	Edmonton
Victoria	Prince Rupert
Cobalt	Sudbury
Winnipeg	Vancouver
	Nelson

Factories at :

Beloeil, Que.
 Vaudrueuil, Que.
 Windsor Mills, Que.
 Waverly, N. S.
 Nanaimo, B. C.
 Northfield, B. C.
 Bowen Island, B. C.
 Parry Sound, Ont.

Canadian Miners' Buying Directory.—(Continued)

Cables—Wire:

Standard Underground Cable Co of Canada, Ltd
Canada Wire & Cable Co.
Fraser & Chalmers of Canada, Ltd.
Northern Electric Co., Ltd.
Osborn, Sam'l (Canada) Limited.
R. T. Gilman & Co.

Cable Railway Systems:

Canada Wire & Cable Co.
Canadian Mead-Morrison Co., Limited.

Cam Shafts:

Canada Foundries & Forgings, Ltd.
Hull Iron & Steel Foundries, Ltd.

Car Dumps:

Sullivan Machinery Co.
R. T. Gilman & Co.
Canadian Fairbanks-Morse Co., Ltd.
Canadian Mead-Morrison Co., Limited.

Carbide of Calcium:

Canada Carbide Company, Ltd.

Cars:

Canadian Foundries and Forgings, Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Canadian Mead-Morrison Co., Limited.
John J. Gartshore
MacKinnon Steel Co., Ltd.
The Electric Steel & Metals Co.
Northern Canada Supply Co.
Osborn, Sam'l (Canada) Limited.
Marsh Engineering Works
Mine and Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
R. T. Gilman & Co.
The Wabi Iron Works

Car Wheels and Axles:

Canadian Car Foundry Co., Ltd.
Burnett & Crampton
Hull Iron & Steel Foundries, Ltd.
John J. Gartshore
Marsh Engineering Works, Ltd.
Osborn, Sam'l (Canada) Limited.
The Electric Steel & Metals Co.
The Wabi Iron Works

Carriers (Gravity):

Jones & Glassco

Castings—Brass

The Canada Metal Co., Ltd.

Castings (Iron and Steel)

Burnett & Crampton
Canadian Steel Foundries, Ltd.
Hull Iron & Steel Foundries, Ltd.
Osborn, Sam'l (Canada) Limited.
The Electric Steel & Metals Co.
The Wabi Iron Works

Cement and Concrete Waterproofing:

Spielman Agencies, Regd.

Cement Machinery:

Northern Canada Supply Co.
Hadfields, Limited
Hull Iron & Steel Foundries, Ltd.
Osborn, Sam'l (Canada) Limited.
Fraser & Chalmers of Canada, Ltd.
Canadian Fairbanks-Morse Co., Ltd.
The Electric Steel & Metals Co.
R. T. Gilman & Co.
Burnett & Crampton

Chains:

Jones & Glassco
Northern Canada Supply Co.
Canadian Fairbanks-Morse Co., Ltd.
Canadian Link-Belt Co., Ltd.
Greening, B., Wire Co., Ltd.

Chain Drives:

Jones & Glassco (Regd.)

Chain Drives—Silent and Steel Roller:

Canadian Link-Belt Co., Ltd.
Hans Renold of Canada, Limited, Montreal, Que.

Chemical Apparatus:

Mine and Smelter Supply Co.

Chemists:

Canadian Laboratories
Campbell & Deyell
Thos. Heyes & Sons
Milton Hersey Co.
Ledoux & Co.
Constant, C. L. Company

Chrome Ore:

The Electric Steel & Metals Co.
Everett & Co.

Classifiers:

Mine and Smelter Supply Co.
Mussens, Limited
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works
R. T. Gilman & Co.
The Dorr Company

Clutches:

Canadian Link-Belt Co., Ltd.
Hans Renold of Canada, Limited, Montreal, Que.

Coal:

Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters:

Osborn, Sam'l (Canada) Limited.
Sullivan Machinery Co.
Canadian Ingersoll-Rand Co., Ltd.

Coal Crushers:

Canadian Mead-Morrison Co., Limited
Canadian Link-Belt Co., Ltd.

Coal Mining Explosives:

Canadian Explosives, Ltd.
Giant Powder Company of Canada, Ltd.

Coal Mining Machinery:

Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
Osborn, Sam'l (Canada) Limited.
Canadian Ingersoll-Rand Co., Ltd.
Sullivan Machinery Co.
Marsh Engineering Works
Hadfields, Ltd.
Hendrick Mfg. Co.
Fraser & Chalmers of Canada, Limited
Mussens, Limited
R. T. Gilman & Co.

Coal and Coke Handling Machinery

Canadian Mead-Morrison Co., Limited.
Canadian Link-Belt Co., Ltd.

Coal Pockets:

Canadian Mead-Morrison Co., Limited.

Coal Pick Machines:

Sullivan Machinery Co.

Coal Screening Plants:

Canadian Link-Belt Co., Ltd.
Canadian Mead-Morrison Co., Limited.

Cobalt Oxide:

Coniagas Reduction Co.
Everitt & Co.

Compressors—Air:

Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Canadian Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.
MacGovern & Co., Inc.
R. T. Gilman & Co.
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
The Mine & Smelter Supply Co.

Concrete Mixers:

Canadian Fairbanks-Morse Co., Ltd.
Northern Canada Supply Co.
Gould, Shapley & Muir Co., Ltd.
MacGovern & Co., Inc.
Mussens, Limited
R. T. Gilman & Co.

Condensers:

Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Northern Canada Supply Co.
MacGovern & Co., Inc.

Concentrating Tables:

The Mine & Smelter Supply Co.
Deister Concentrator Co.
The Wabi Iron Works

Converters:

Northern Canada Supply Co.
MacGovern & Co., Inc.

Conveyors—McCaslin Gravity Bucket:

Canadian Mead-Morrison Co., Limited.

Contractors' Supplies:

Canadian Fairbanks-Morse Co., Ltd.

Consulters and Engineers:

Hersey Milton Co., Ltd.

Conveyors:

Canadian Link-Belt Co., Ltd.
The Mine & Smelter Supply Co.
Jones & Glassco (Regd.)

Conveyor Belts:

Gutta Percha & Rubber, Ltd.

Conveyor Flights:

Canadian Link-Belt Co., Ltd.
Hendrick Mfg. Co., Ltd.

Conveyor—Trough—Belt:

Canadian Fairbanks-Morse Co., Ltd.
Canadian Link-Belt Co., Ltd.
Hendrick Mfg. Co.
Mussens, Limited
Jones & Glassco (Roller, Belt and Chain)
Hendrick Mfg. Co.
The Wabi Iron Works

Conical Mills:

Hardinge Conical Mill Co.

Copper:

The Canada Metal Co., Ltd.
Consolidated Mining & Smelting Co.

Couplings:

Hans Renold of Canada, Limited, Montreal, Que.

Cranes:

Canadian Fairbanks-Morse Co., Ltd.
Canadian Mead-Morrison Co., Limited.
Canadian Link-Belt Company
R. T. Gilman & Co.
Smart-Turner Machine Co.

Crane Ropes:

Allan White & Co.
Canada Wire & Cable Co.
Greening, B., Wire Co., Ltd.

Crucibles:

Canadian Fairbanks-Morse Co., Ltd.
The Mine & Smelter Supply Co.

Crusher Balls:

Canada Foundries & Forgings, Ltd.
Hull Iron & Steel Foundries, Limited, Hull, Que.
Osborn, Sam'l (Canada) Limited.

Swedish Steel & Importing Co., Ltd.

Crushers:

Canadian Fairbanks-Morse Co., Ltd.
Canadian Steel Foundries, Ltd.
Hull Iron & Steel Foundries, Ltd.
Hardinge Conical Mill Co.
Osborn, Sam'l (Canada) Limited.
The Electric Steel & Metals Co., Ltd.
R. T. Gilman & Co.
Lymans, Ltd.
Mussens, Limited

THE CONIAGAS REDUCTION COMPANY, LIMITED

St. Catharines - - - Ontario

Smelters and Refiners of Cobalt Ores

Manufacturers of

Copper Sulphate

Bar Silver—Electrolytically Refined

Arsenic—White and Metallic

Cobalt Oxide and Metal

Nickel, Oxide and Metal

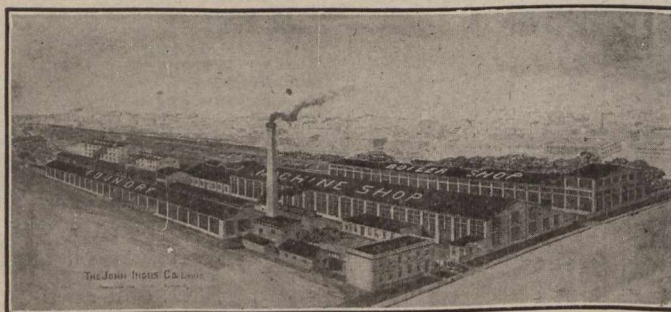
Telegraphic Address:
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Canadian Miners' Buying Directory.—(Continued)

- The Mine & Smelter Supply Co.
Hadfields, Limited
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works
- Cut Gears:**
Hans Renold of Canada, Limited, Montreal, Que.
- Cyanide:**
American Cyanamid Company.
- Cyanide Plant Equipment:**
The Dorr Co.
The Mine & Smelter Supply Co.
- D. C. Units:**
MacGovern Co.
- Derricks:**
Smart-Turner Machine Co.
Canadian Mead-Morrison Co., Limited.
Marsh Engineering Works
R. T. Gilman & Co.
Canadian Fairbanks-Morse Co., Ltd.
Mussens, Limited
- Diamond Drill Contractors:**
Diamond Drill Contracting Co.
E. J. Longyear Company
Smith & Travers
Sullivan Machinery Co.
- Diamond Tools:**
Diamond Drill Carbon Co.
- Diamond Importers:**
Diamond Drill Carbon Co.
- Digesters:**
Canadian Chicago Bridge and Iron Works
- Dies:**
Canada Foundries & Forgings, Ltd.
Hull Iron & Steel Foundries, Ltd.
- Dredger Pins:**
Canadian Steel Foundries, Ltd.
Hull Iron & Steel Foundries, Ltd.
The Electric Steel & Metals Co.
Hadfields, Limited
- Dredging Machinery:**
Canadian Steel Foundries, Ltd.
Canadian Mead-Morrison Co., Limited
Hadfields, Limited
Hull Iron & Steel Foundries, Ltd.
R. T. Gilman & Co.
- Dredging Ropes:**
Allan, Whyte & Co.
Greening, B., Wire Co., Ltd.
R. T. Gilman & Co.
- Drills, Air and Hammer:**
Canadian Ingersoll-Rand Co., Ltd.
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
Sullivan Machinery Co.
Northern Canada Supply Co.
Osborn, Sam'l (Canada) Limited.
The Mine & Smelter Supply Co.
Mussens, Limited
- Drills—Core:**
Canadian Ingersoll-Rand Co., Ltd.
E. J. Longyear Company
Standard Diamond Drill Co.
Sullivan Machinery Co.
- Drills—Diamond:**
Sullivan Machinery Co.
Northern Canada Supply Co.
E. J. Longyear Company
- Drill Steel—Mining:**
H. A. Drury Co., Ltd.
Hadfields, Limited
International High Speed Steel Co., Rockawa
Osborn, Sam'l (Canada) Limited.
Mussens, Limited
Swedish Steel & Importing Co., Ltd.
- Drill Steel Sharpeners:**
Canadian Ingersoll-Rand Co., Ltd.
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
Northern Canada Supply Co.
Sullivan Machinery Co.
Osborn, Sam'l (Canada) Limited.
The Wabi Iron Works
- Drills—Electric:**
Canadian Fairbanks-Morse Co., Ltd.
Sullivan Machinery Co.
Northern Electric Co., Ltd.
- Drills—High Speed and Carbon:**
Canadian Fairbanks-Morse Co., Ltd.
Osborn, Sam'l (Canada) Limited.
H. A. Drury Co., Ltd.
Hadfields, Limited
- Dynamite:**
Canadian Explosives
Giant Powder Company of Canada, Ltd.
Northern Canada Supply Co.
- Dynamics:**
Canadian Fairbanks-Morse Co., Ltd.
MacGovern & Company
- Ejectors:**
Canadian Fairbanks-Morse Co. Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.
- Elevators:**
Canadian Mead-Morrison Co., Limited.
Canadian Link-Belt Co., Ltd.
Sullivan Machinery Co.
Northern Canada Supply Co.
Hadfields, Limited
Fraser & Chalmers of Canada, Ltd.
Jones & Glassco (Regd.)
Mussens, Limited
The Wabi Iron Works
- Engineering Instruments:**
C. L. Berger & Sons
- Engines—Automatic:**
Canadian Fairbanks-Morse Co., Ltd.
Canadian Mead-Morrison Co., Limited.
Fraser & Chalmers of Canada, Ltd.
- Engines—Gas and Gasoline:**
Canadian Fairbanks-Morse Co., Ltd.
Alex. Fleck
Fraser & Chalmers of Canada, Ltd.
Osborn, Sam'l (Canada) Limited.
Sullivan Machinery Co.
Gould, Shapley & Muir Co., Ltd.
MacGovern & Co., Inc.
The Mine & Smelter Supply Co.
- Engines—Haulage:**
Canadian Ingersoll-Rand Co., Ltd., Montreal.
Canadian Mead-Morrison Co., Limited.
Marsh Engineering Works
Fraser & Chalmers of Canada, Ltd.
- Engines—Marine:**
Canadian Fairbanks-Morse Co., Ltd.
MacGovern & Co., Inc.
Swedish Steel & Importing Co., Ltd.
- Engines—Steam:**
Canadian Fairbanks-Morse Co., Ltd.
Canadian Mead-Morrison Co., Limited.
R. T. Gilman & Co.
MacGovern & Co., Inc.
Fraser & Chalmers of Canada, Ltd.
- Engines—Stationery:**
Swedish Steel & Importing Co., Ltd.
- Engineers:**
General Engineering Co., New York
The Dorr Co.
- Ferro-Alloys (all Classes):**
Everitt & Co.
- Feed Water Heaters:**
MacGovern & Co.
- Fire Fighting Supplies:**
Gutta Percha & Rubber, Ltd.
- Flashlights—Electric:**
Spielman Agencies, Regd.
- Flood Lamps:**
Northern Electric Co., Ltd.
- Flourspar:**
The Consolidated Mining & Smelting Co.
Everitt & Co.
- Forges:**
Canadian Fairbanks-Morse Co., Ltd.
Northern Canada Supply Co.
- Forging:**
Canadian Mead-Morrison Co., Limited.
Canadian Foundries and Forgings, Ltd.
Hull Iron & Steel Foundries, Ltd.
Smart-Turner Machine Co.
Hadfields, Limited
Fraser & Chalmers of Canada, Ltd.
- Frogs:**
Canadian Steel Foundries, Ltd.
Hull Iron & Steel Foundries, Ltd.
John J. Gartshore
- Frequency Changers:**
MacGovern & Co., Inc.
- Furnaces—Assay:**
Canadian Fairbanks-Morse Co., Ltd.
Lymans, Limited
Mine & Smelter Supply Co.
- Fuse:**
Canadian Explosives
Giant Powder Company of Canada, Ltd.
Northern Canada Supply Co.
- Gaskets:**
Gutta Percha & Rubber, Ltd.
- Gears:**
Hans Renold of Canada, Limited, Montreal, Que.
Jones & Glassco (Regd.)
- Gears (Cast):**
Hull Iron & Steel Foundries, Ltd.
Canadian Link-Belt Co., Ltd.
- Gears, Machine Cut:**
Canadian Fairbanks-Morse Co., Ltd.
Canadian Steel Foundries, Ltd.
The Electric Steel & Metals Co.
The Hamilton Gear & Machine Co.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works
- Granulators:**
Hardinge Conical Mill Co.
- Grinding Wheels:**
Canadian Fairbanks-Morse Co., Ltd.
- Gold Refiners**
Goldsmith Bros

Canadian Miners' Buying Directory.—(Continued)

- Gold Trays:**
Canada Chicago Bridge & Iron Works
- Hose (Air Drill):**
Goodyear Tire & Rubber Co.
Gutta Percha & Rubber, Ltd.
- Hose (Fire):**
Goodyear Tire & Rubber Co.
Gutta Percha & Rubber, Ltd.
- Hose (Packings)**
Goodyear Tire & Rubber Co.
Gutta Percha & Rubber, Ltd.
- Hose (Suction):**
Goodyear Tire & Rubber Co.
Gutta Percha & Rubber, Ltd.
- Hose (Steam):**
Goodyear Tire & Rubber Co.
Gutta Percha & Rubber, Ltd.
- Hose (Water):**
Goodyear Tire & Rubber Co.
Gutta Percha & Rubber, Ltd.
- Hammer Rock Drills:**
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
Osborn, Sam'l (Canada) Limited.
Mussens, Limited
The Mine & Smelter Supply Co.
- Hangers and Cable:**
Standard Underground Cable Co. of Canada, Ltd.
- High Speed Steel:**
Canadian Fairbanks-Morse Co. Ltd.
H. A. Drury Co., Ltd.
Osborn, Sam'l (Canada) Limited.
Hadfields, Limited
International High Speed Steel Co., Rockaway
- High Speed Steel Twist Drills:**
Canadian Fairbanks-Morse Co., Ltd.
H. A. Drury Co., Ltd.
Northern Canada Supply Co.
Osborn, Sam'l (Canada) Limited.
- Hoists—Air, Electric and Steam:**
Canadian Ingersoll-Rand Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
Jones & Glassco
Canadian Mead-Morrison Co., Limited.
Marsh Engineering Works
Northern Canada Supply Co.
Mine & Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works
R. T. Gilman & Co.
Mussens, Limited
Canadian Link-Belt Co., Ltd.
- Hoisting Engines:**
Canadian Fairbanks-Morse Co., Ltd.
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
The Electric Steel & Metals Co.
Mussens, Limited
Sullivan Machinery Co.
Canadian Ingersoll-Rand Co., Ltd.
Canadian Mead-Morrison Co., Limited
Marsh Engineering Works
Fraser & Chalmers of Canada, Ltd.
The Mine & Smelter Supply Co.
- Hoisting Towers:**
Canadian Mead-Morrison Co., Limited.
- Hose:**
Canadian Fairbanks-Morse Co., Ltd.
Gutta Percha & Rubber, Ltd.
Northern Canada Supply Co.
- Hose (Steam, Air, Water):**
Gutta Percha & Rubber, Ltd.
- Hydraulic Machinery:**
Canadian Fairbanks-Morse Co., Ltd.
Hadfields, Limited
MacGovern & Co., Inc.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works
- Industrial Chemists:**
Hersey, M. & Co., Ltd.
- Ingot Copper:**
Canada Metal Co., Ltd.
Hoyt Metal Co.
- Insulating Compounds:**
Standard Underground Cable Co. of Canada, Ltd.
- Inspection and Testing:**
Dominion Engineering & Inspection Co.
- Inspectors:**
Hersey, M. & Co., Ltd.
- Jacks:**
Canadian Fairbanks-Morse Co., Ltd.
Can. Brakeshoe Co., Ltd.
Northern Canada Supply Co.
R. T. Gilman & Co.
Mussens, Limited
- Jack Screws:**
Canadian Foundries and Forgings, Ltd.
- Laboratory Machinery:**
Mine & Smelter Supply Co.
- Lamps—Acetylene:**
Dewar Manufacturing Co., Inc.
- Lamps—Carbide:**
Dewar Manufacturing Co., Inc.
- Lamps—Miners:**
Canada Carbide Company, Limited
Canadian Fairbanks-Morse Co., Ltd.
Dewar Manufacturing Co., Inc.
Northern Electric Co., Ltd.
Mussens, Limited
- Lamps:**
Dewar Manufacturing Co., Inc.
- Lanterns—Electric:**
Spielman Agencies, Regd.
- Lead (Pig):**
The Canada Metal Co., Ltd.
Consolidated Mining & Smelting Co.
Hoyt Metal Company.
- Levels:**
C. L. Berger & Sons
- Locomotives (Steam, Compressed Air and Storage Steel):**
Canadian Fairbanks-Morse Co., Ltd.
H. K. Porter Company
R. T. Gilman & Co.
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
- Link Belt**
Canadian Fairbanks-Morse Co. Ltd.
Canadian Link-Belt Co., Ltd.
Northern Canada Supply Co.
Jones & Glassco
- Machinists:**
Burnett & Crampton
- Machinery—Repair Shop:**
Canadian Fairbanks-Morse Co., Ltd.
- Machine Shop Supplies:**
Canadian Fairbanks-Morse Co., Ltd.
- Magnesium Metal:**
Everitt & Co.
Hull Iron & Steel Foundries, Ltd.
- Manganese Steel:**
Canadian Steel Foundries, Ltd.
The Electric Steel & Metals Co.
Hadfields, Limited
Osborn, Sam'l (Canada) Limited.
Hull Iron & Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works
- Metal Marking Machinery:**
Canadian Fairbanks-Morse Co., Ltd.
- Metal Merchants:**
Henry Bath & Son
Geo. G. Blackwell, Sons & Co.
Coniagas Reduction Co.
Consolidated Mining & Smelting Co. of Canada
Canada Metal Co.
C. L. Constant Co.
Everitt & Co.
Hoyt Metal Company.
- Metallurgical Engineers:**
General Engineering Co., New York
The Durr Co.
- Metallurgical Machinery:**
General Engineering Co., New York
The Durr Co.
The Mine & Smelter Supply Co.
- Metal Work, Heavy Plates:**
Canada Chicago Bridge & Iron Works
- Mica:**
Everitt & Co.
Diamond Drill Carbon Co.
- Mining Engineers:**
Hersey, M. Co., Ltd.
- Mining Drill Steel:**
H. A. Drury Co., Ltd.
Osborn, Sam'l (Canada) Limited
International High Speed Steel Co., Rockaway, N.
- Mining Requisites:**
Canadian Steel Foundries, Ltd.
Dominion Wire Rope Co., Ltd.
Hadfields, Limited
Osborn, Sam'l (Canada) Limited.
Hull Iron & Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works
- Mining Ropes:**
Dominion Wire Rope Co., Ltd.
- Mine Surveying Instruments:**
C. L. Berger & Sons
- Molybdenite:**
Everitt & Co.
- Monel Metal (Wire, Rod, Sheet and Foundry Metal):**
International Nickel Co.
- Motors:**
Canadian Fairbanks-Morse Co., Ltd.
R. T. Gilman & Co.
MacGovern & Co.
The Mine & Smelter Supply Co.
The Wabi Iron Works

Canadian Miners' Buying Directory.—(Continued)

Motor Generator Sets—A.C. and D.C.
MacGovern & Co.

Nails:
Canada Metal Co.

Nickel:
International Nickel Co.
Coniagas Reduction Co.
The Mond Nickel Co., Ltd.

Nickel Anodes:
The Mond Nickel Co., Ltd.

Nickel Salts:
The Mond Nickel Co., Ltd.

Nickel Sheets:
The International Nickel Co. of Canada
The Mond Nickel Co., Ltd.

Nickel Wire:
The Mond Nickel Co., Ltd.
The International Nickel Co. of Canada

Oil Analysts:
Constant, C. L. Co.

Ore Handling Equipment:
Canadian Mead-Morrison Co., Limited.
Canadian Link-Belt Co., Ltd.

Ore Sacks:
Northern Canada Supply Co.

Ore Testing Works:
Ledoux & Co.
Can. Laboratories
Milton Hersey Co.
Campbell & Deyell
General Engineering Co., New York
Hoyt Metal Co.

Ores and Metals—Buyers and Sellers of:
C. L. Constant Co.
Geo. G. Blackwell
Consolidated Mining and Smelting Co. of Canada
Oxford Copper Co.
Canada Metal Co.
Hoyt Metal Co.
Everitt & Co.
Pennsylvania Smelting Co.

Packing:
Canadian Fairbanks-Morse Co., Ltd.
Gutta Percha & Rubber, Ltd.

Paints—Special:
Spielman Agencies, Regd.

Perforated Metals:
Northern Canada Supply Co.
Hendrick Mfg. Co.
Canada Wire and Iron Goods Company.
Greening, B., Wire Co.

Permissible Explosives:
Giant Powder Company of Canada, Ltd.

Pig Tin:
Canada Metal Co., Ltd.
Hoyt Metal Co.

Pig Lead:
Canada Metal Co., Ltd.
Hoyt Metal Co.
Pennsylvania Manufacturing Co.

Pillow Blocks:
Canadian Link-Belt Company

Pipes:
Canadian Fairbanks-Morse Co., Ltd.
Canada Metal Co., Ltd.
Consolidated M. & S. Co.
Northern Canada Supply Co.
R. T. Gilman & Co.

Pipe Fittings:
Canadian Fairbanks-Morse Co., Ltd.

Pipe—Wood Stave:
Pacific Coast Pipe Co.
Mine & Smelter Supply Co.

Piston Rock Drills:
Mussens, Limited
Mine & Smelter Supply Co.

Plate Works:
John Inglis Co., Ltd.
Hendrick Mfg. Co.
The Wabi Iron Works
MacKinnon Steel Co., Ltd.

Platinum Refiners:
Goldsmith Bros.

Pneumatic Tools:
Canadian Ingersoll-Rand Co., Ltd.
R. T. Gilman & Co.

Powder:
Giant Powder Company of Canada, Ltd.

Prospecting Mills and Machinery:
The Electric Steel & Metals Co.
E. J. Longyear Company
Standard Diamond Drill Co.
Mine & Smelter Supply Co.
Fraser & Chalmers of Canada, L.
The Wabi Iron Works

Pumps—Pneumatic:
Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Sullivan Machinery Co.

Pumps—Steam:
Canadian Fairbanks-Morse Co., Ltd.
Canadian Ingersoll-Rand Co., Ltd.
The Electric Steel & Metals Co.
The Mine & Smelter Supply Co.
Mussens, Limited
Northern Canada Supply Co.
Smart-Turner Machine Co.
R. T. Gilman & Co.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Pumps—Turbine:
Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Canadian Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Pumps—Vacuum:
Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
The Wabi Iron Works

Pumps—Valves:
Canadian Fairbanks-Morse Co., Ltd.

Pulleys, Shaftings and Hangings:
Northern Canada Supply Co.
Canadian Fairbanks-Morse Co., Ltd.
The Wabi Iron Works

Pulverizers—Laboratory:
Mine & Smelter Supply Co.
The Wabi Iron Works
Hardinge Conical Mill Co.

Pumps—Boiler Feed:
Smart-Turner Machine Co.
Northern Canada Supply Co.
Canadian Fairbanks-Morse Co., Ltd.
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
Mine & Smelter Supply Co.

Pumps—Centrifugal:
Canadian Fairbanks-Morse Co., Ltd.
The Electric Steel & Metals Co.
Smart-Turner Machine Co.
Canadian Mead-Morrison Co., Limited.
Canadian Ingersoll-Rand Co., Ltd.
Mine & Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Pumps—Diaphragm
The Dorr Company

Pumps—Electric
Canadian Fairbanks-Morse Co., Ltd.
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
Smart-Turner Machine Co.

Pumps—Sand and Slime:
Canadian Fairbanks-Morse Co., Ltd.
Fraser & Chalmers of Canada, Ltd.
Mine & Smelter Supply Co.
The Electric Steel & Metals Co.
The Wabi Iron Works
Smart-Turner Machine Co.

Quarrying Machinery:
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
Sullivan Machinery Co.
Canadian Ingersoll-Rand Co., Ltd.
Hadfields, Limited
Mussens, Limited
R. T. Gilman Co.

Rails:
Hadfields, Limited
John J. Gartshore
R. T. Gilman & Co.
Mussens, Limited

Railway Supplies:
Canadian Fairbanks-Morse Co., Ltd.

Refiners:
Goldsmith Bros.

Riddles:
Hendrick Mfg. Co.

Roller Chain:
Hans Renold of Canada, Limited, Montreal, Que.
Canadian Link-Belt Co., Ltd.

Roofing:
Canadian Fairbanks-Morse Co., Ltd.
Northern Canada Supply Co.

Rope—Manilla:
Osborn, Sam'l (Canada) Limited.
Mussens, Limited

Rope—Manilla and Jute:
Jones & Glassco
Northern Canada Supply Co.
Osborn, Sam'l (Canada) Limited.
Allan. Whyte & Co.

Canadian Miners' Buying Directory.—(Continued)

Rope—Wire:

Allan, Whyte & Co., Ltd.
Canada Wire & Cable Co.
Dominion Wire Rope Co., Ltd.
Greening, B. Wire Co.
Northern Canada Supply Co.
Mussens, Limited

Rolls—Crushing

Canadian Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
Hull Iron & Steel Foundries, Ltd.
Osborn, Sam'l (Canada) Limited.
Hadfields, Limited
The Electric Steel & Metals Co.
Mussens, Limited
The Wabi Iron Works

Samplers:

Fraser & Chalmers of Canada, Ltd.
C. L. Constant Co.
Ledoux & Co.
Milton Hersey Co.
Thos. Heyes & Son
Mine & Smelter Supply Co.
Mussens, Limited

Scales—(all kinds):

Canadian Fairbanks-Morse Co., Ltd.

Screens:

Greening, B. Wire Co.
Hendrick Mfg. Co.
Mine & Smelter Supply Co.
Canada Wire and Iron Goods Company.
Canadian Link-Belt Co., Ltd.

Screens—Cross Patent Flanged Lip:

Hendrick Mfg. Co.

Screens—Perforated Metal:

Hendrick Mfg. Co.

Screens—Shaking:

Canadian Link-Belt Co., Ltd.
Hendrick Mfg. Co.

Screens—Evolving:

Canadian Link-Belt Co., Ltd.
Hendrick Mfg. Co.

Scheelite:

Everitt & Co.

Separators:

Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Mine & Smelter Supply Co.

Shaft Contractors:

Hendrick Mfg. Co.

Sheet Metal Work:

Hendrick Mfg. Co.

Sheets—Genuine Manganese Bronze:

Hendrick Mfg. Co.

Shoes and Dies:

Canadian Foundries and Forgings, Ltd.
H. A. Drury Co., Ltd.
Fraser & Chalmers of Canada, Ltd.
Hull Iron & Steel Foundries, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works

Shovels—Steam:

Canadian Foundries and Forgings, Ltd.
Canadian Mead-Morrison Co., Limited.
Osborn, Sam'l (Canada) Limited.
R. T. Gilman & Co.

Ship Bunkering Equipment:

Canadian Mead-Morrison Co., Limited.

Silent Chain:

Canadian Link-Belt Co., Ltd.
Hans Renold of Canada, Limited, Montreal, Que.

Silent and Steel Roller:

Canadian Link-Belt Co., Ltd.
Jones & Glassco (Regd.)

Silver:

Contagas Reduction Co.

Saline Refiners:

Goldsmith Bros.

Smelters:

Goldsmith Bros.

Sledges:

Canada Foundries & Forgings, Ltd.

Smoke Stacks:

Hendrick Mfg. Co.
MacKinnon Steel Co., Ltd.
Marsh Engineering Works
The Wabi Iron Works

Solder—Bar and Wire:

Hoyt Metal Company

Special Machinery:

John Inglis Co., Ltd.

Spelter:

The Canada Metal Co., Ltd.
Consolidated Mining & Smelting Co.

Sprockets:

Hans Renold of Canada, Limited, Montreal, Que.
Canadian Link-Belt Co., Ltd.
Jones & Glassco (Regd.)

Spring Coil and Clips Electric:

Canadian Steel Foundries, Ltd.

Steel Barrels:

Smart-Turner Machine Co.
Fraser & Chalmers of Canada, Ltd.

Stamp Forgings:

Canada Foundries & Forgings, Ltd.
Hull Iron & Steel Foundries, Ltd.

Steel Castings:

Canadian Brakeshoe Co., Ltd.
Canadian Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
Osborn, Sam'l (Canada) Limited.
Hull Iron & Steel Foundries, Ltd.
The Electric Steel & Metals Co.
Hadfields, Limited
The Wabi Iron Works

Steel Drills:

Canadian Fairbanks-Morse Co., Ltd.
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
Sullivan Machinery Co.
Northern Canada Supply Co.
The Electric Steel & Metals Co.
Osborn, Sam'l (Canada) Limited.
Canadian Ingersoll-Rand Co., Ltd.
Mussens, Limited
Swedish Steel & Importing Co., Ltd.

Steel Drums:

Smart-Turner Machine Co.

Steel—Tool:

Canadian Fairbanks-Morse Co., Ltd.
H. A. Drury Co., Ltd.
N. S. Steel & Coal Co.
Osborn, Sam'l (Canada) Limited.
Hadfields, Limited
Swedish Steel & Importing Co., Ltd.

Structural Steel Work (Light):

Hendrick Mfg. Co.

Stone Breakers:

Hadfields, Limited
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
Osborn, Sam'l (Canada) Limited.
Mussens, Limited
R. T. Gilman & Co.
The Wabi Iron Works

Sulphate of Copper:

The Mond Nickel Co., Ltd.
Contagas Reduction Co.

Sulphate of Nickel:

The Mond Nickel Co., Ltd.

Surveying Instruments:

C. L. Berger

Switches and Switch Stand:

Canadian Steel Foundries, Ltd.
Mussens, Limited.

Switches and Turntables:

John J. Gartshore

Tables—Concentrating:

Mine & Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.

Tanks:

R. T. Gilman & Co.

Tanks—Acid:

Canadian Chicago Bridge & Iron Works
The Mine & Smelter Supply Co.

Tanks (Wooden):

Canadian Fairbanks-Morse Co., Ltd.
Gould, Shapley & Muir Co., Ltd.
Pacific Coast Pipe Co., Ltd.
Mine & Smelter Supply Co.
The Wabi Iron Works

Tanks—Cyanide, Etc.:

Hendrick Mfg. Co.
Pacific Coast Pipe Co.
MacKinnon Steel Co.
Fraser & Chalmers of Canada, Ltd.
Mine & Smelter Supply Co.
The Wabi Iron Works

Tanks—Steel:

Canadian Fairbanks-Morse Co., Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Canadian Chicago Bridge & Iron Works
Marsh Engineering Works
Osborn, Sam'l (Canada) Limited.
MacKinnon Steel Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
Hendrick Mfg. Co.
The Wabi Iron Works

Tanks—Oil Storage:

Canadian Chicago Bridge & Iron Works
The Mine & Smelter Supply Co.

Tanks (water) and Steel Towers:

Canadian Fairbanks-Morse Co., Ltd.
Canadian Chicago Bridge & Iron Works
Gould, Shapley & Muir Co., Ltd.
MacKinnon Steel Co.
Mine & Smelter Supply Co.
The Wabi Iron Works

Tires—Auto, Truck and Bicycle:

Gutta Percha & Rubber, Ltd.

Canadian Miners' Buying Directory.—(Continued)

- Tramway Points and Crossings:**
Canadian Steel Foundries, Ltd.
Hadfields, Limited
- Transits:**
C. L. Berger & Sons
- Transformers:**
Canadian Fairbanks-Morse Co., Ltd.
R. T. Gilman & Co.
Northern Electric Co., Ltd.
- Transmission Apparatus:**
Jones & Glassco (Regd.)
- Transmission Machinery:**
Canadian Link-Belt Co., Ltd.
Hans Renold of Canada, Limited, Montreal, Que.
Jones & Glassco (Regd.)
- Troughs (Conveyor):**
Hendrick Manufacturing Co.
- Trucks—Electric:**
Canadian Fairbanks-Morse Co., Ltd.
- Trucks—Hand:**
Canadian Fairbanks-Morse Co., Ltd.
- TTrucks:**
Canadian Fairbanks-Morse Co., Ltd.
- Tubs:**
Hadfields, Limited
- Tube Mills:**
The Electric Steel & Metals Co.
Fraser & Chalmers of Canada, Ltd.
Hardinge Conical Mill Co.
- Tube Mill Balls:**
Canada Foundries & Forgings, Ltd.
Fraser & Chalmers of Canada, Ltd.
Hull Iron & Steel Foundries, Ltd.
- Tube Mill Liners:**
Burnett & Crampton
Fraser & Chalmers of Canada, Ltd.
Hull Iron & Steel Foundries, Ltd.
- Turbines—Water Wheel:**
MacGovern & Co.
- Turbines—Steam:**
Fraser & Chalmers of Canada, Ltd.
MacGovern & Co.
- Twincones:**
Canada Foundries & Forgings, Ltd.
- Uranium:**
Everitt & Co.
- Weighing Larries:**
Canadian Mead-Morrison Co., Limited.
- Welding—Rod and Flux:**
Prest-O-Lite Co. of Canada, Ltd.
Imperial Brass Mfg. Co.
- Welding and Cutting—Oxy-Acetylene:**
Prest-O-Lite Co. of Canada, Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Imperial Brass Mfg. Co.
- Wheels and Axles:**
Canadian Steel Foundries, Ltd.
Hadfields, Limited
The Electric Steel & Metals Co.
The Wabi Iron Works
- Winches—Power Driven:**
Canadian Mead-Morrison Co., Limited.
- Winding Engines—Steam and Electric:**
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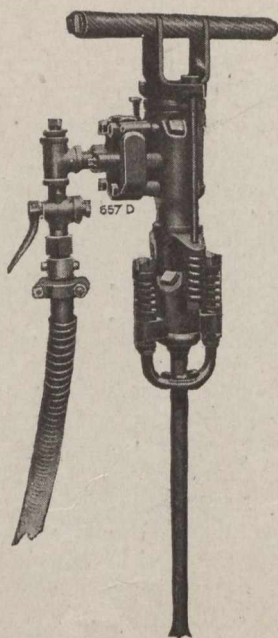
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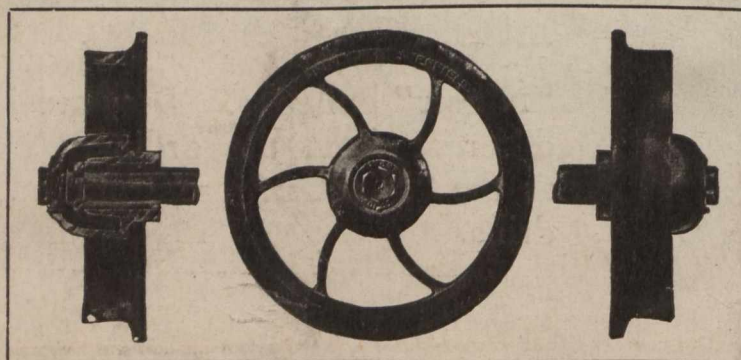
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